United States Patent [19]

Inoue et al.

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[45] **Date of Patent: May 1, 1990**

[54] **COIN WRAPPING APPARATUS**

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[21] Appl. No.: **238,004**

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[30] **Foreign Application Priority Data**

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Aug. 31, 1987 [JP] Japan 62-218930
Sep. 11, 1987 [JP] Japan 62-229312

[51] **Int. Cl.**[5] **B65B 11/04**; B65B 35/50
[52] **U.S. Cl.** **53/532**; 53/212; 53/215; 453/61
[58] **Field of Search** 53/532, 211, 212, 215, 53/587, 216; 100/87; 453/62, 61; 414/675

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Primary Examiner—John Sipos
Attorney, Agent, or Firm—Jordan and Hamburg

[57] **ABSTRACT**

A coin wrapping apparatus for automatically piling coins in a specified number and wrapping a pile of coins in wrapping comprising a pair of main rollers, a proper number of guide rollers, and a belt passed over these rollers and bent at a portion thereof between the pair of main rollers into a curved shape to form a coin holding means as its main part which constitutes a coin piling unit so as to make it possible to attain coin piling function by a simpler structure. A coin piling and wrapping unit for piling and wrapping coins is constructed using the main part which can perform piling and wrapping in the same section and can be moved into and from the main body of the coin wrapping apparatus.

29 Claims, 21 Drawing Sheets

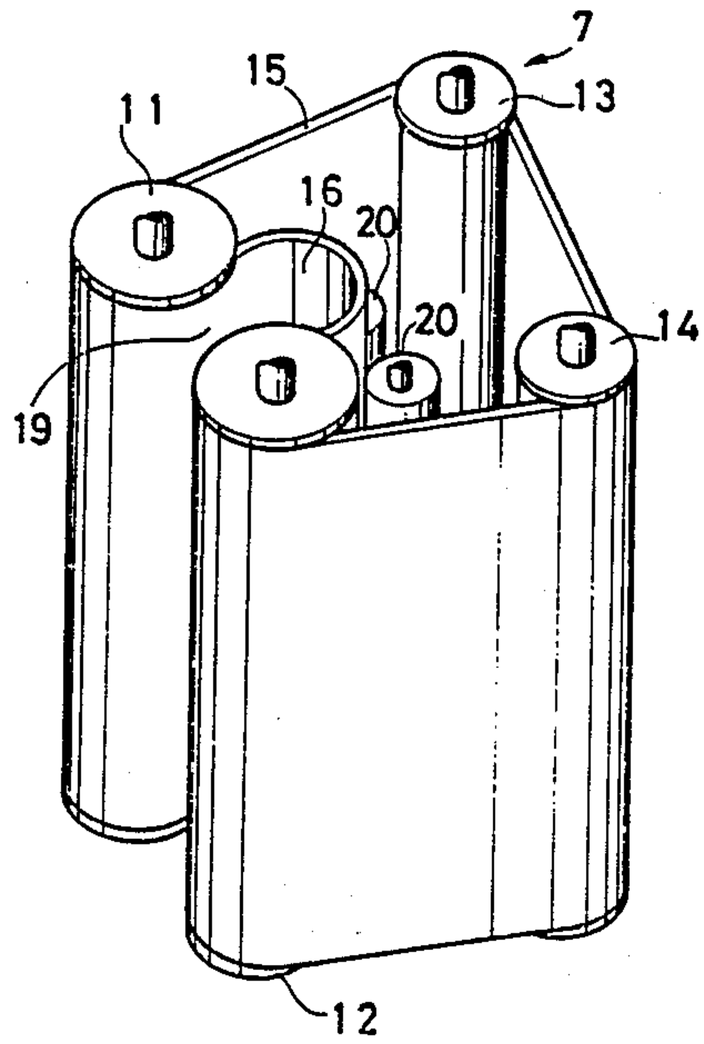

FIG. 1

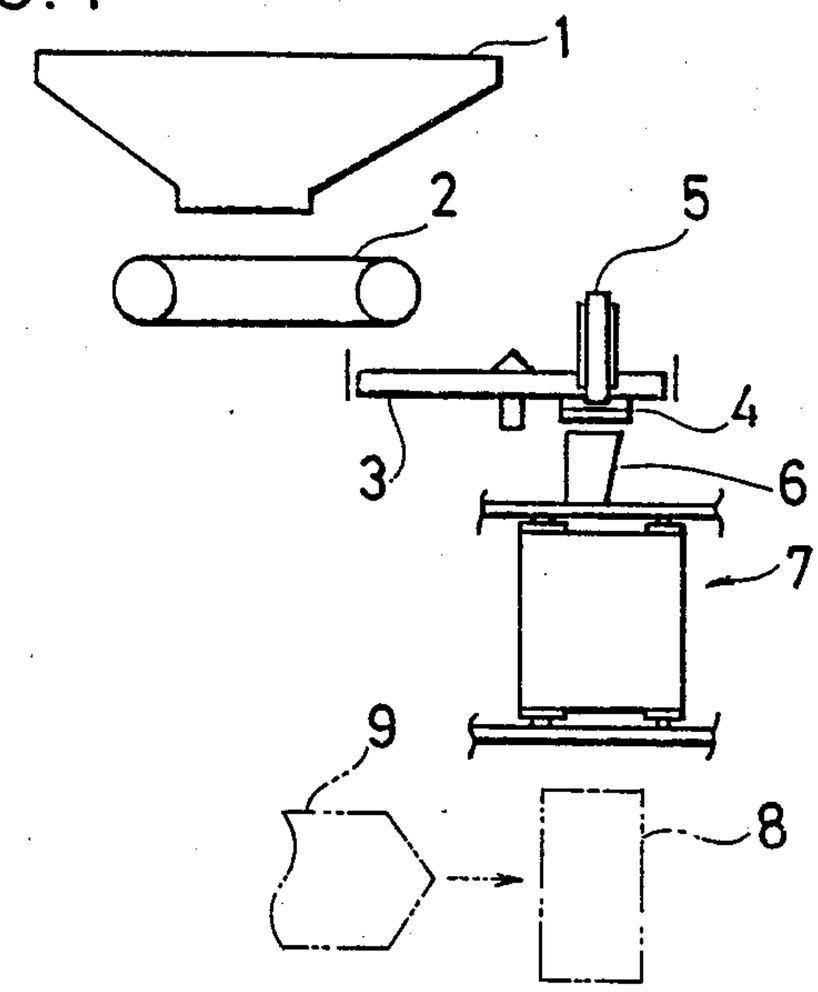

FIG. 2

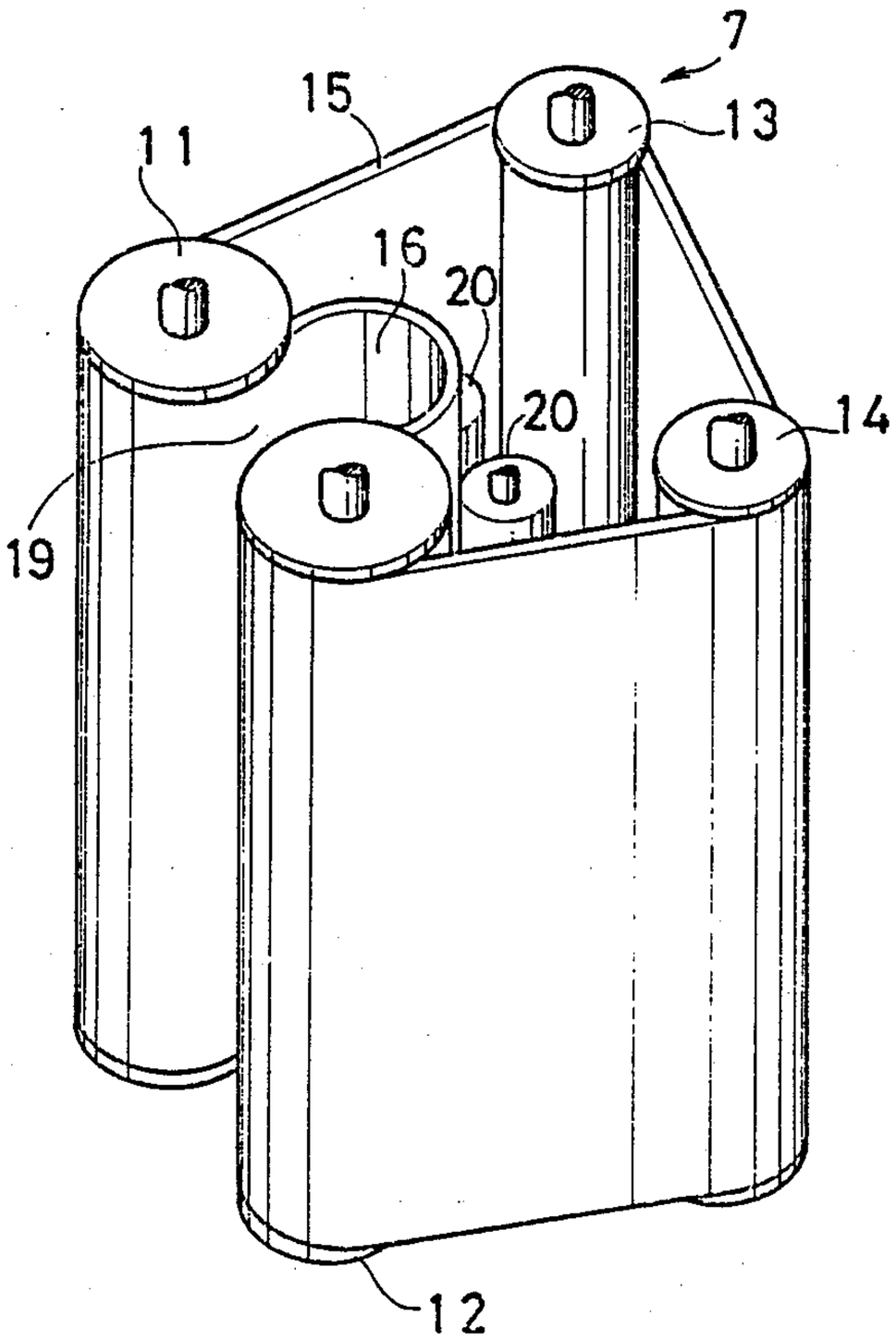

FIG. 3

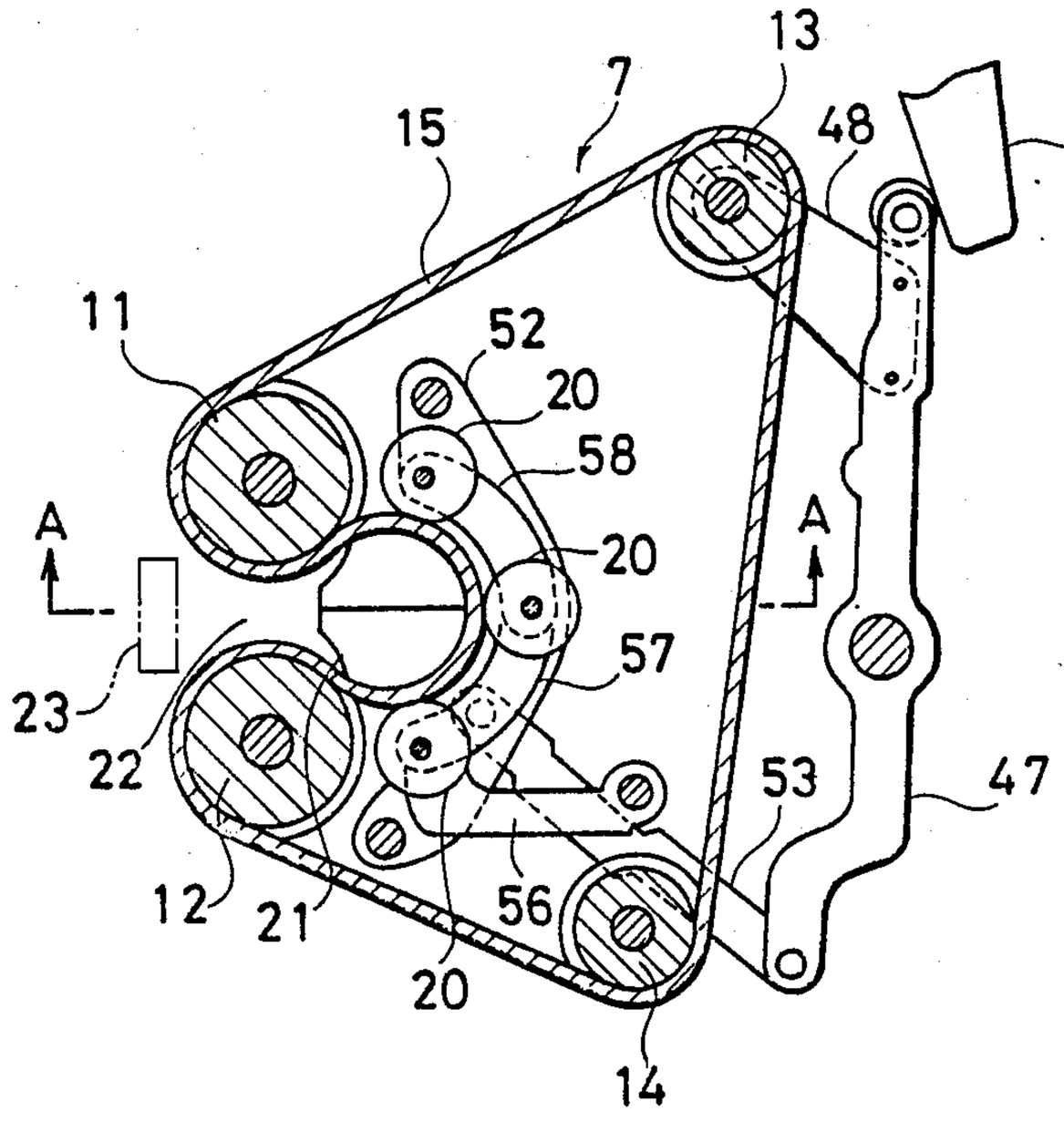

FIG. 4

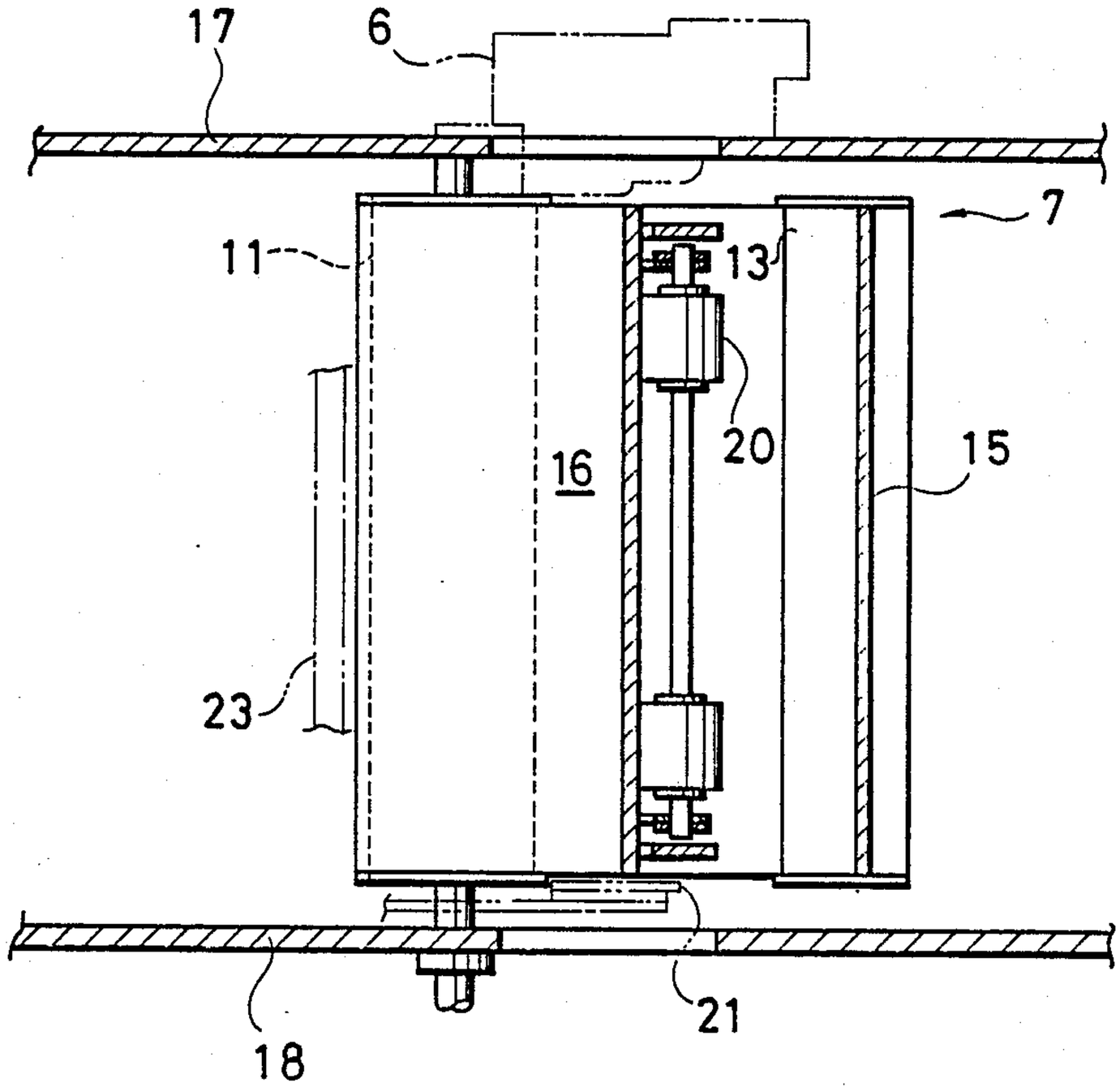

FIG.5

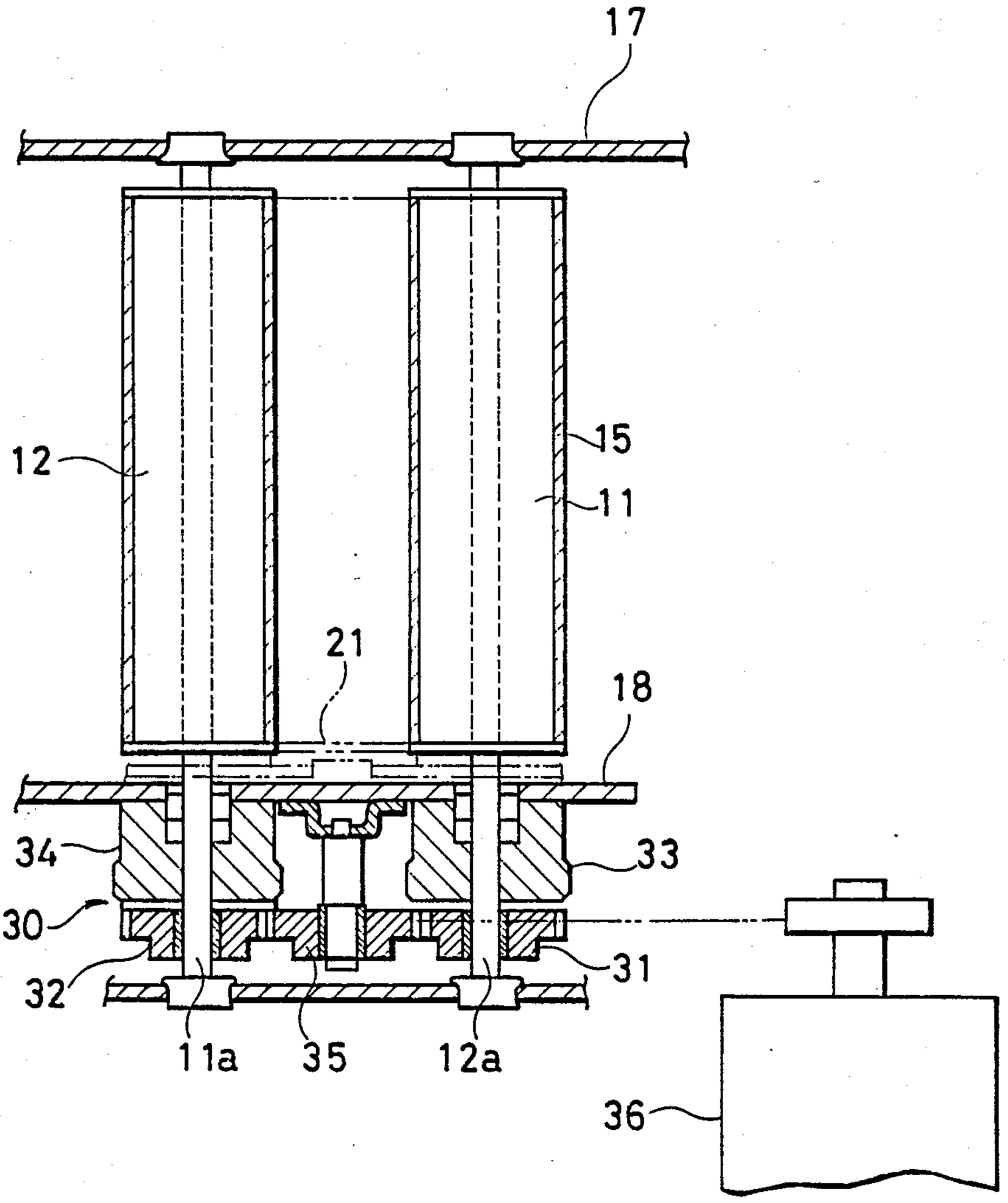

FIG.6

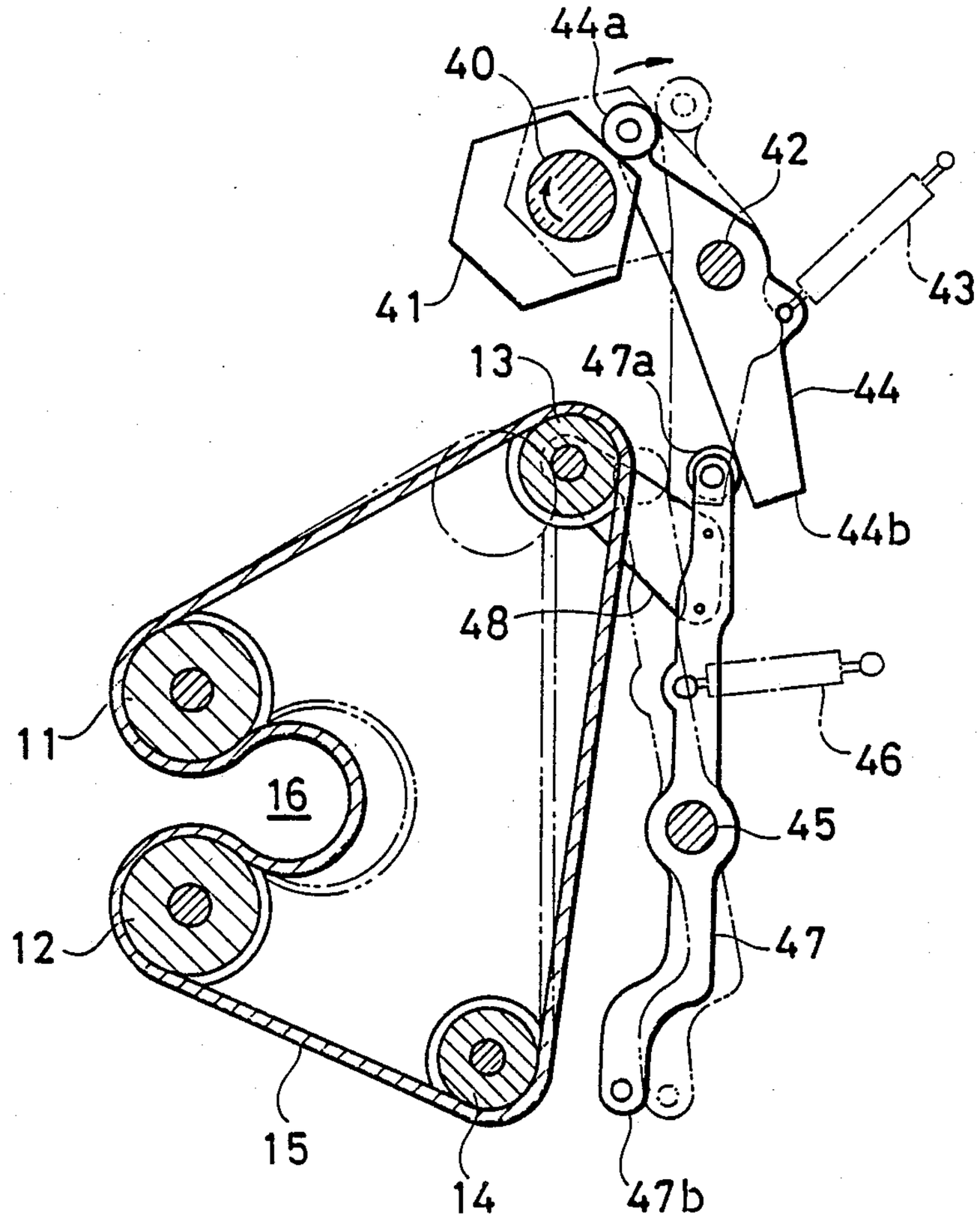

FIG. 7

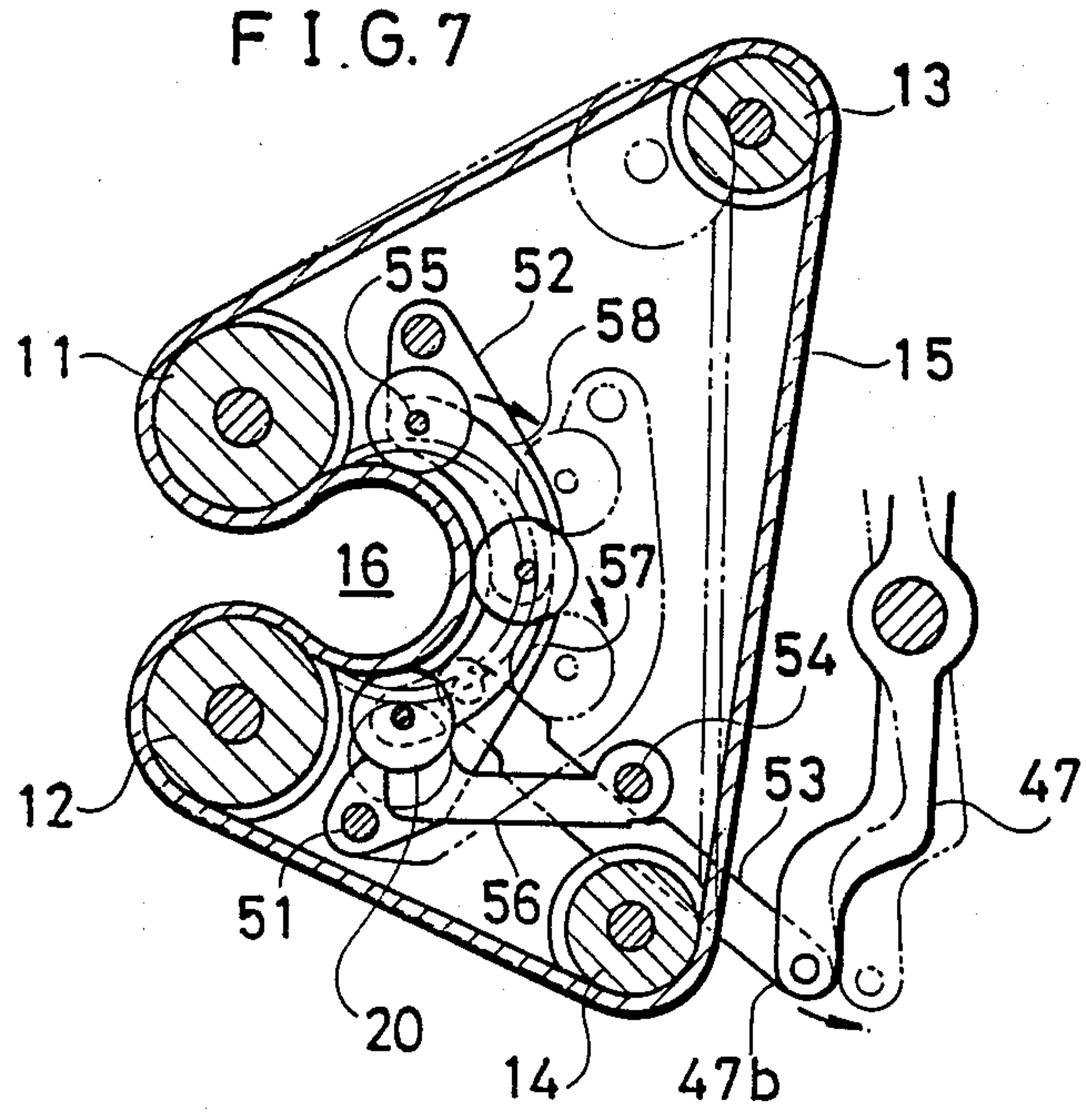
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FIG. 8

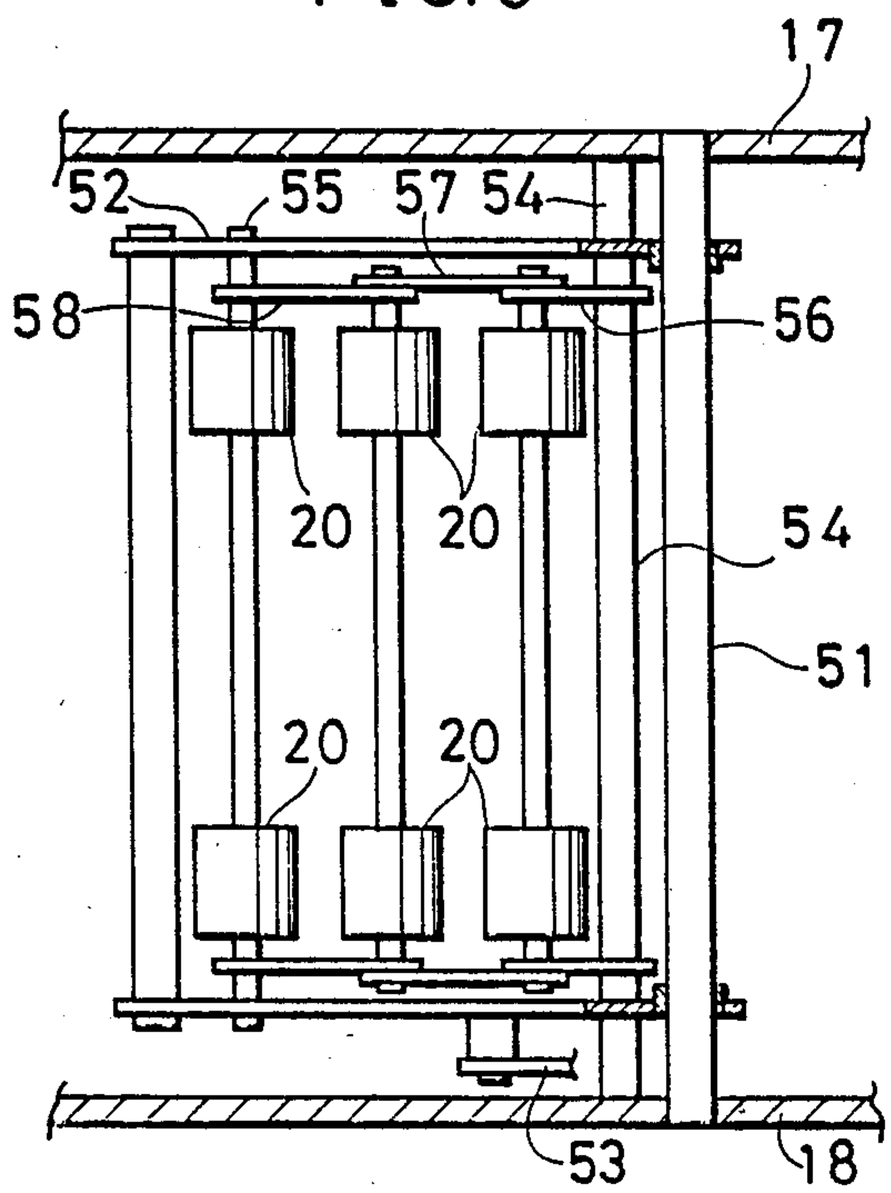
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FIG.9

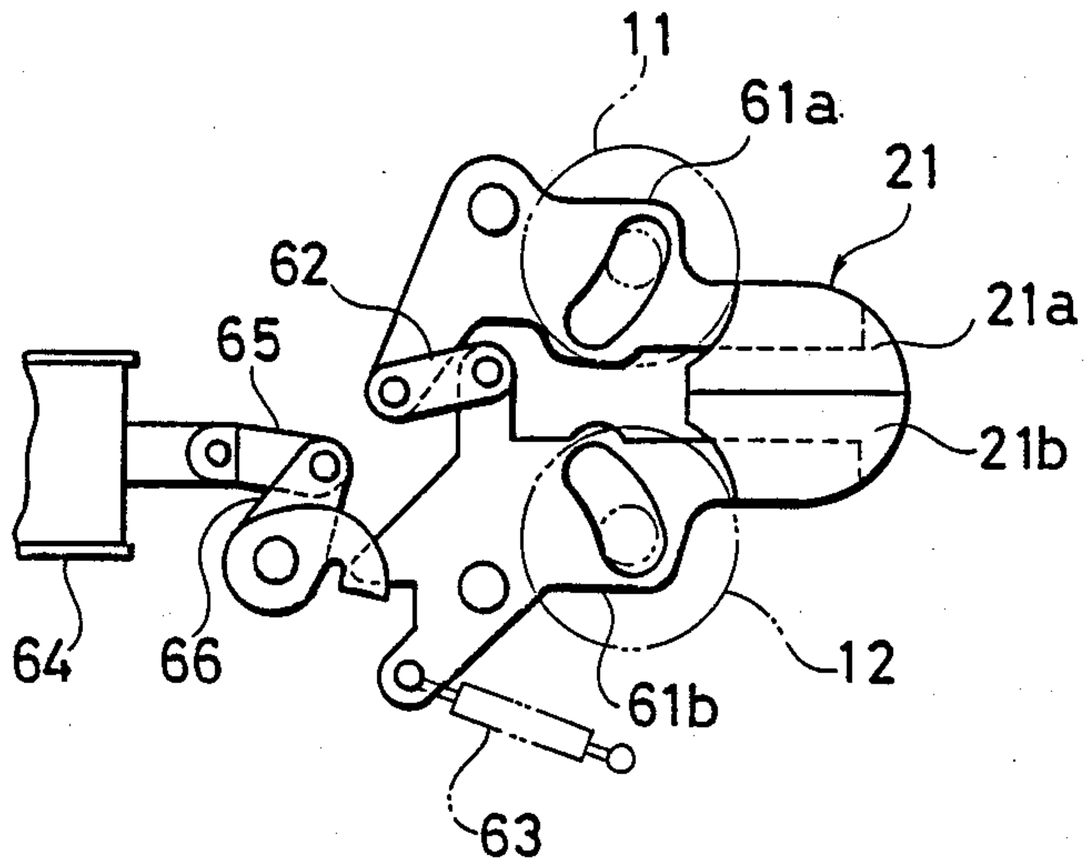
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FIG.10

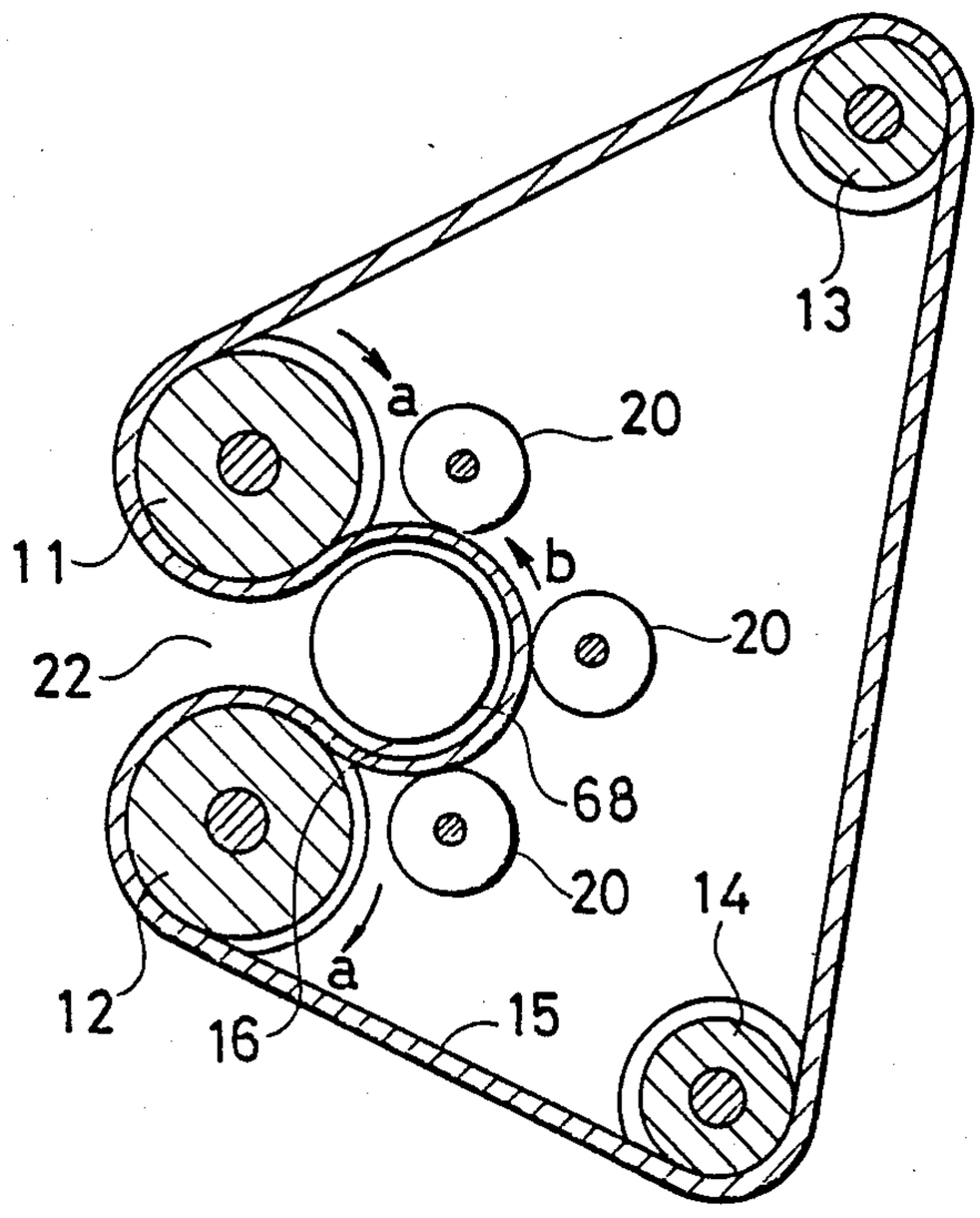
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FIG.11

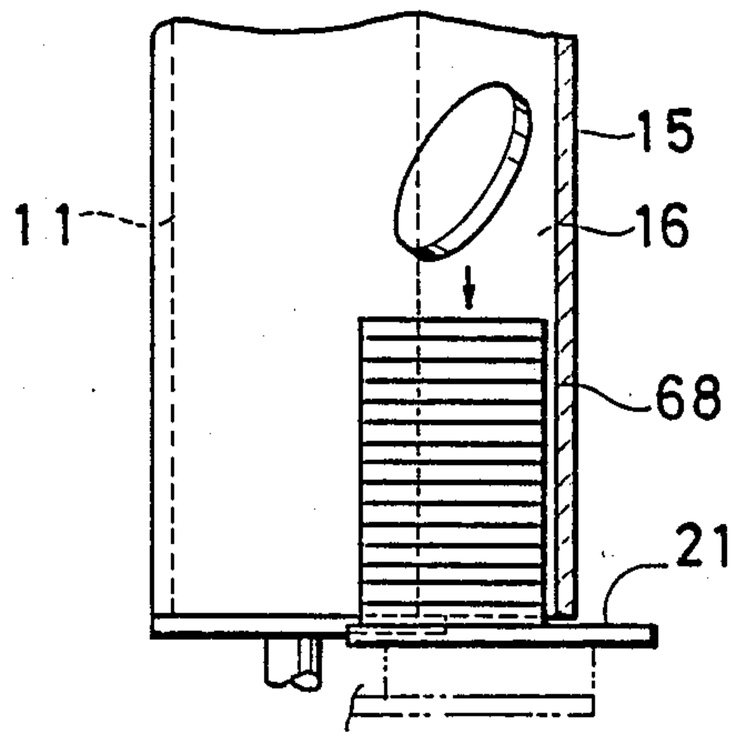


FIG.12

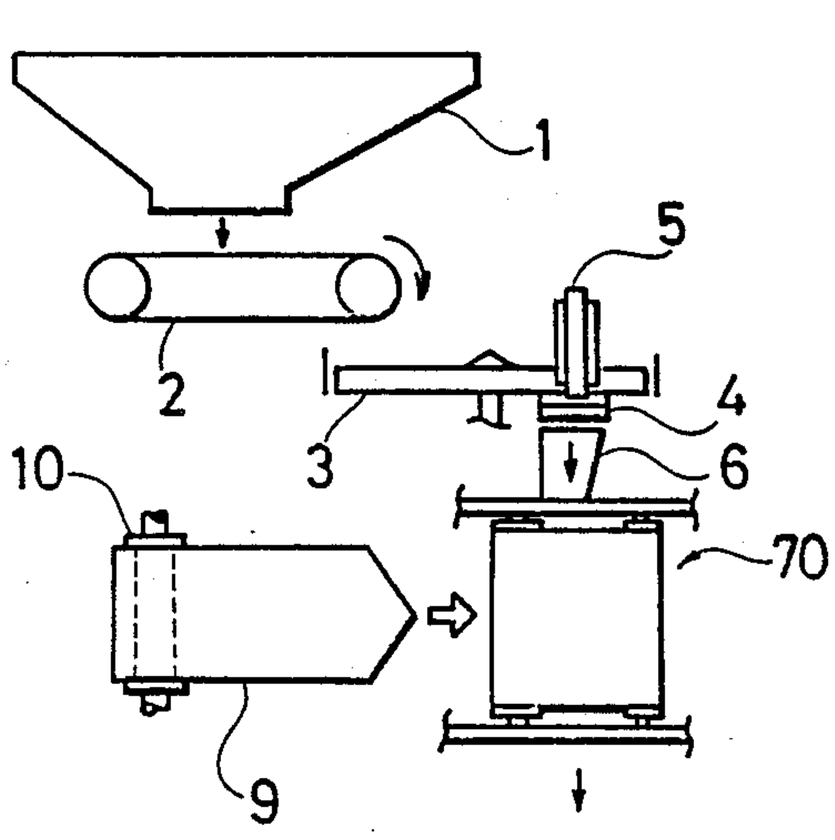


FIG.13

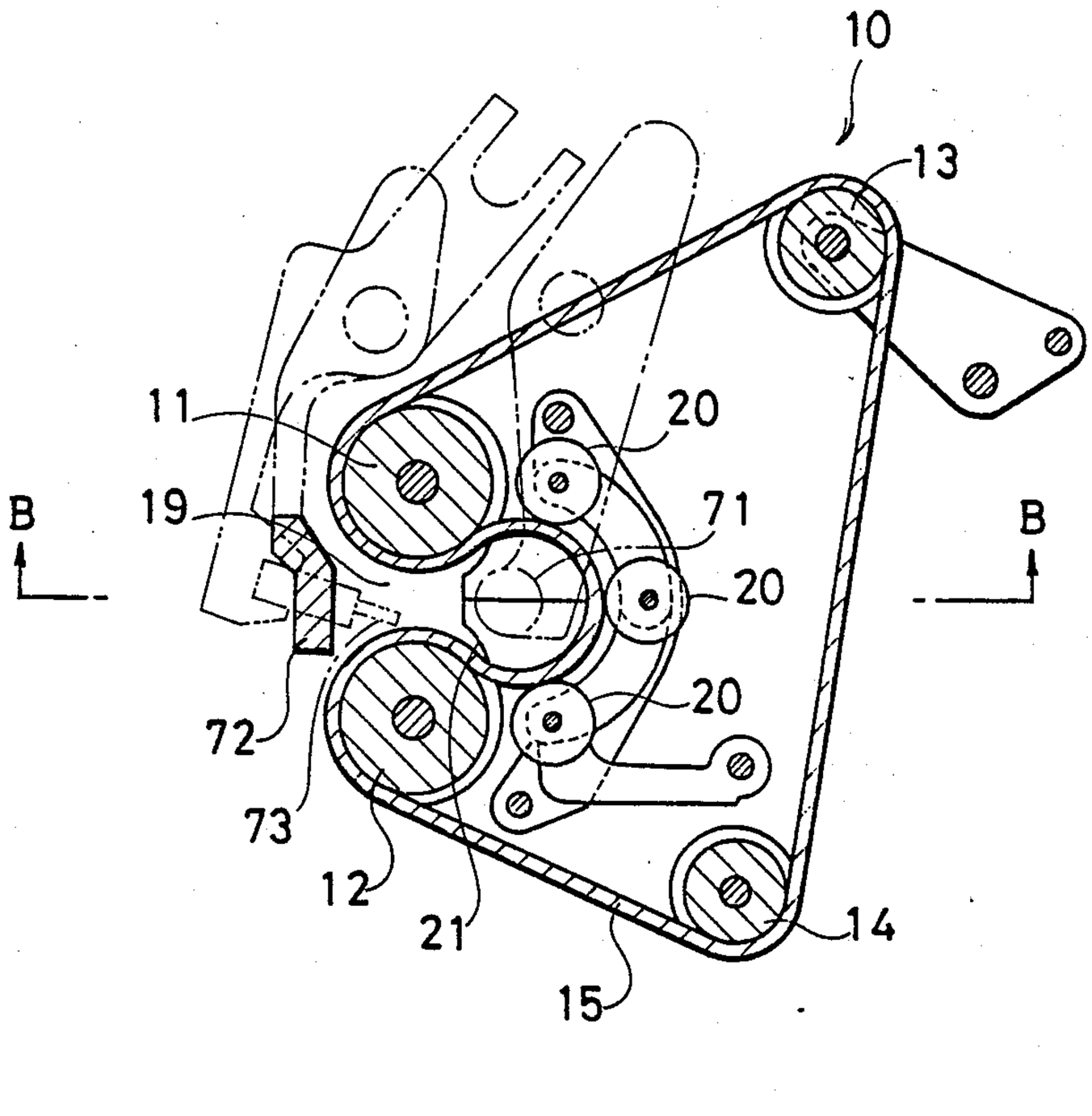
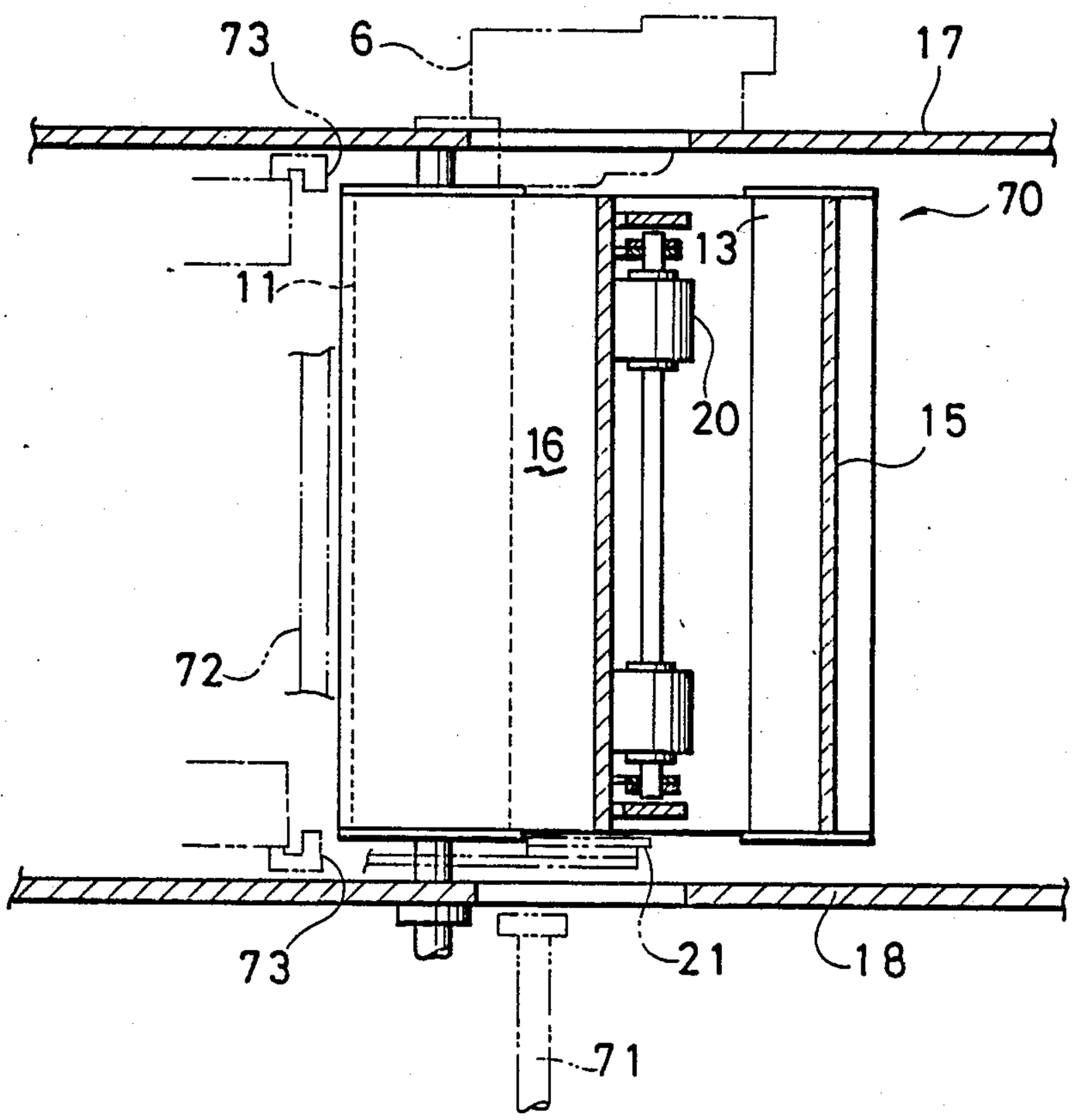


FIG.14



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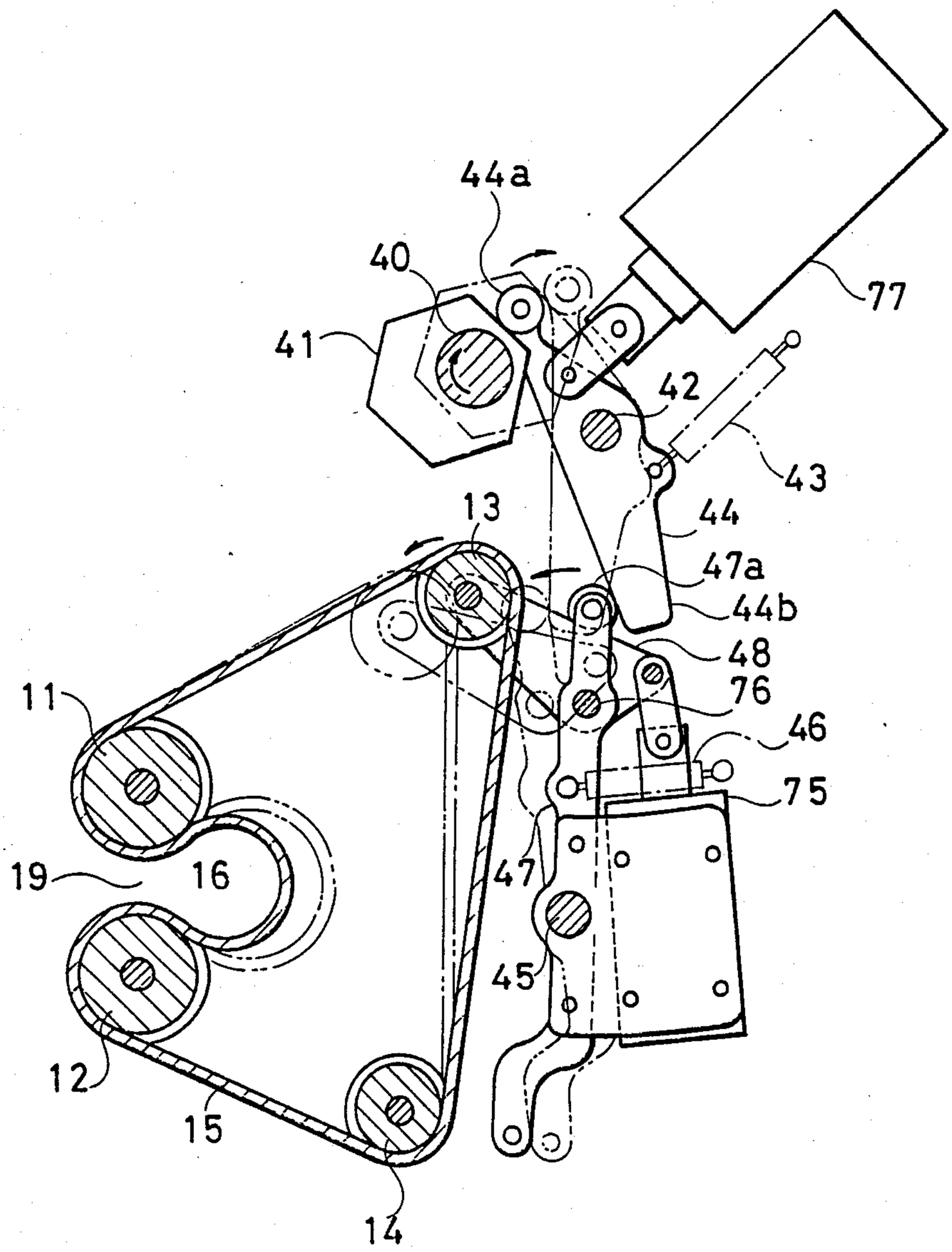


FIG.16

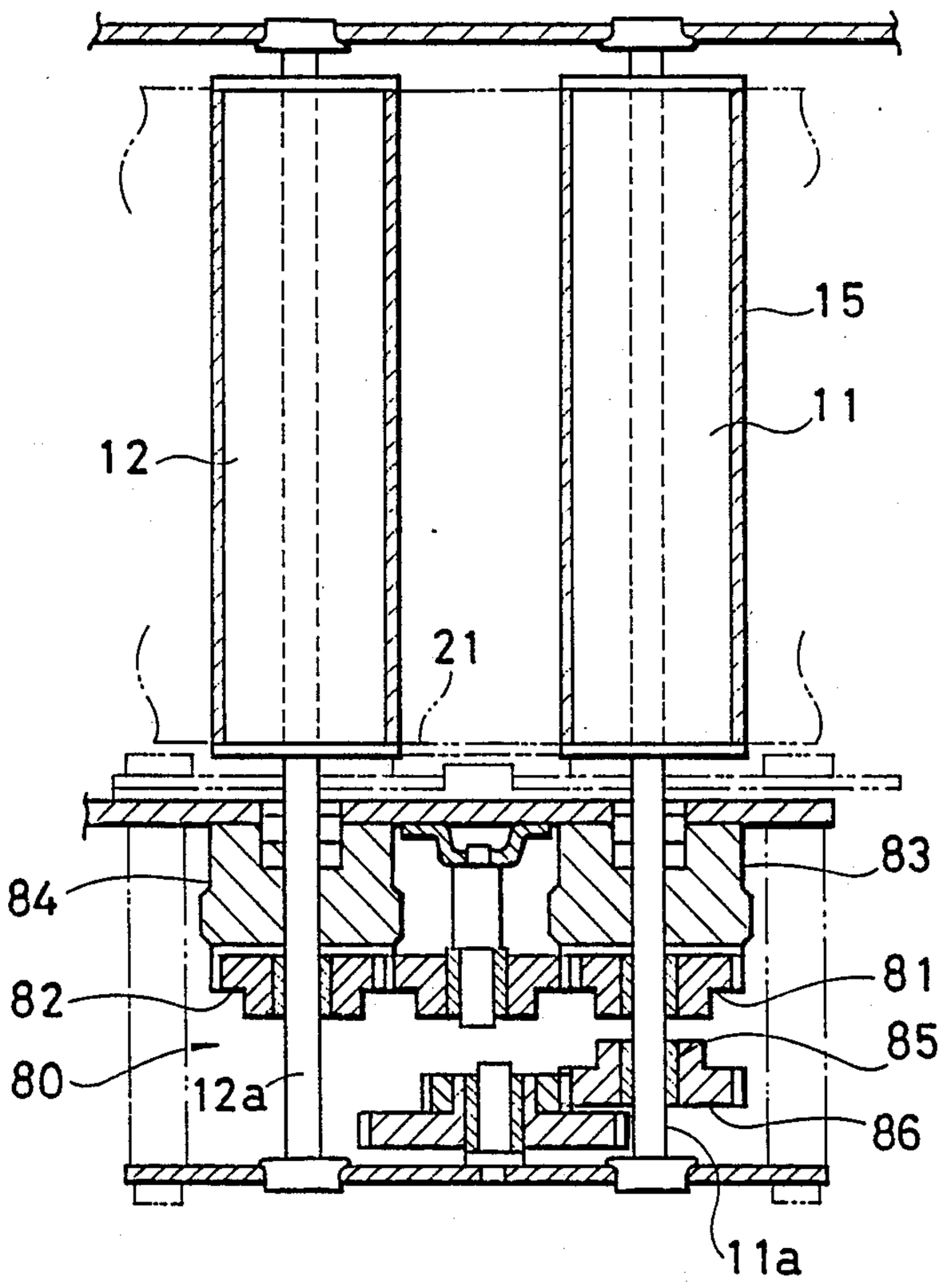


FIG.17

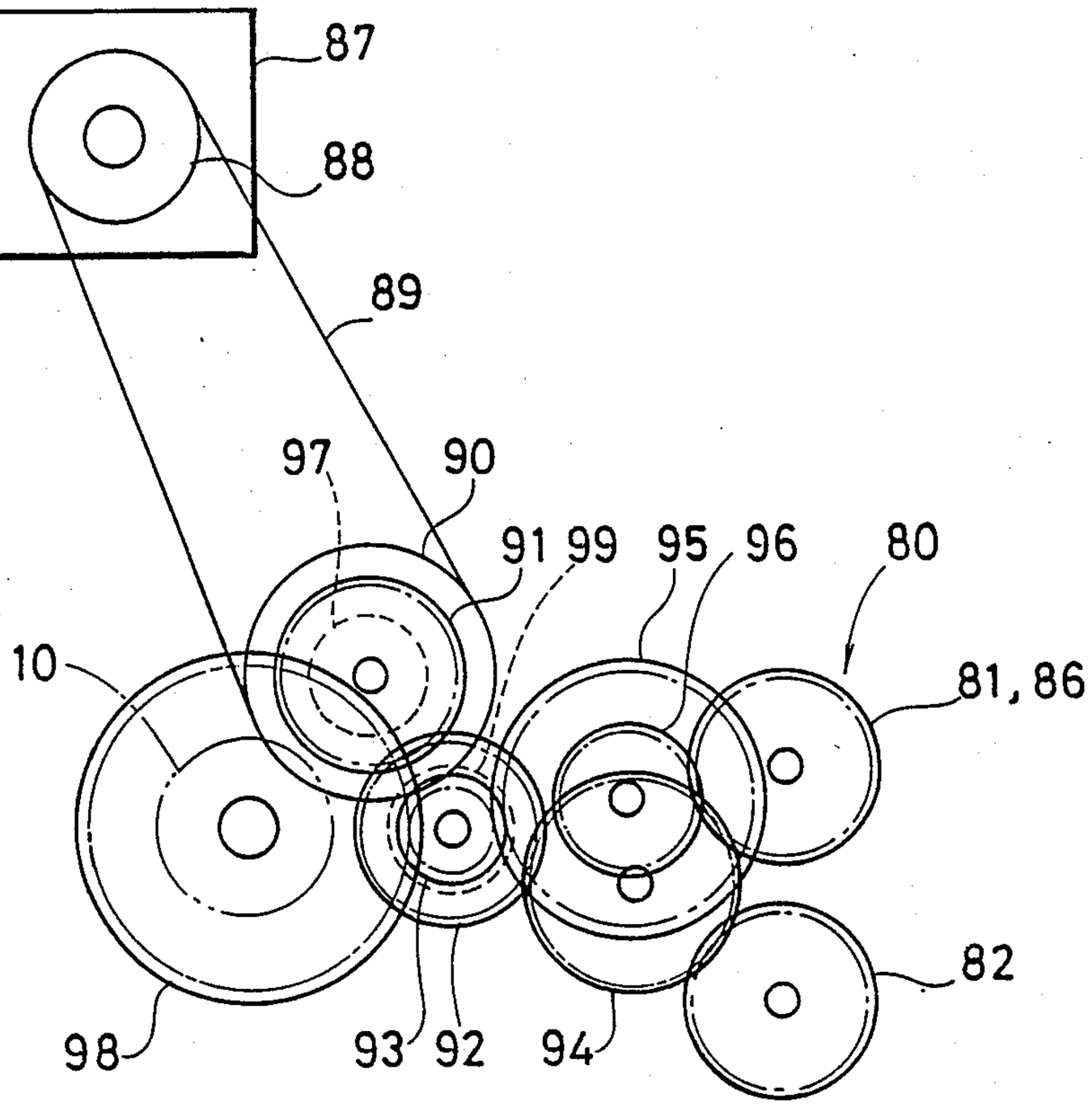


FIG.18

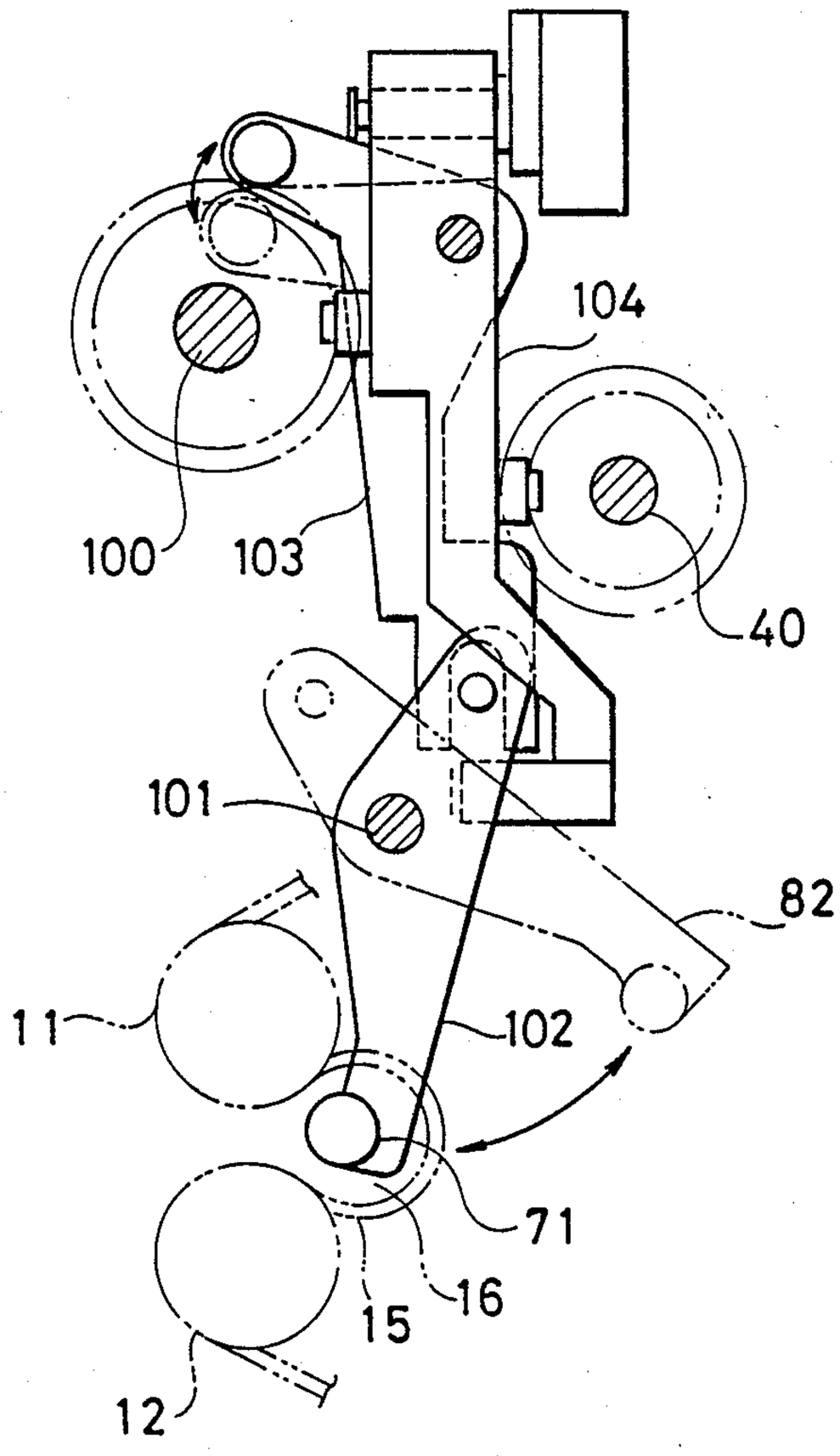


FIG. 20

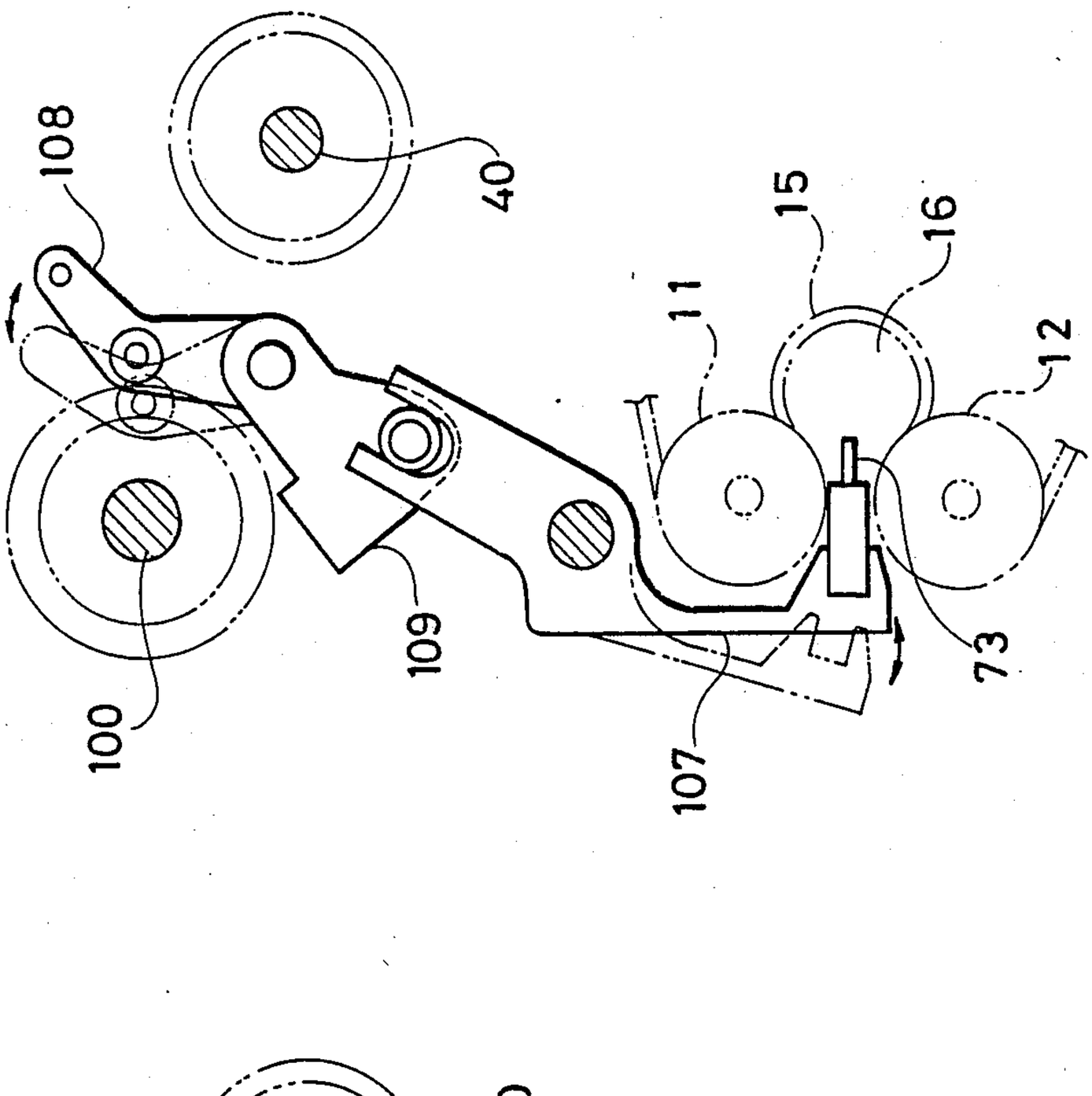
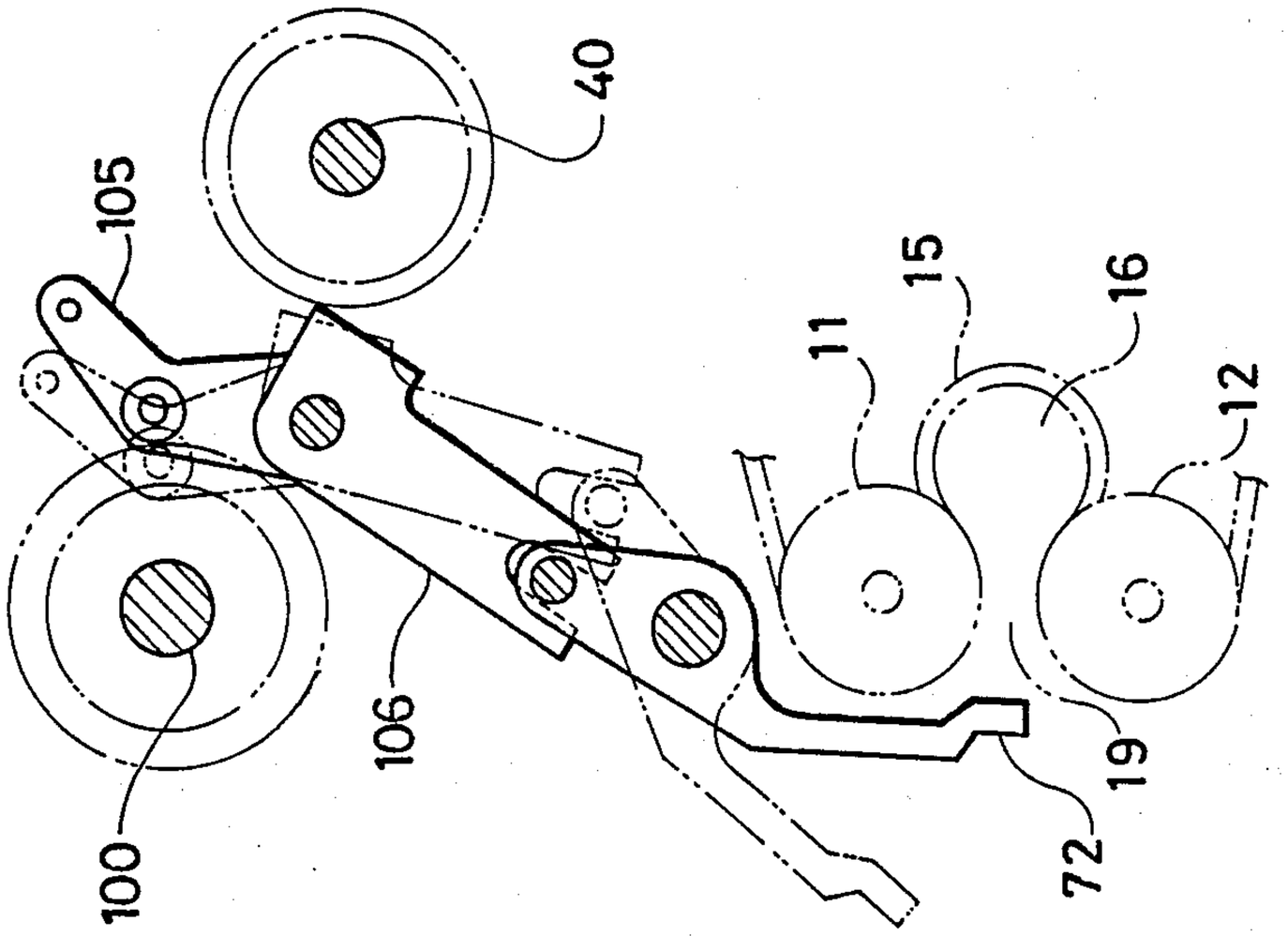


FIG. 19



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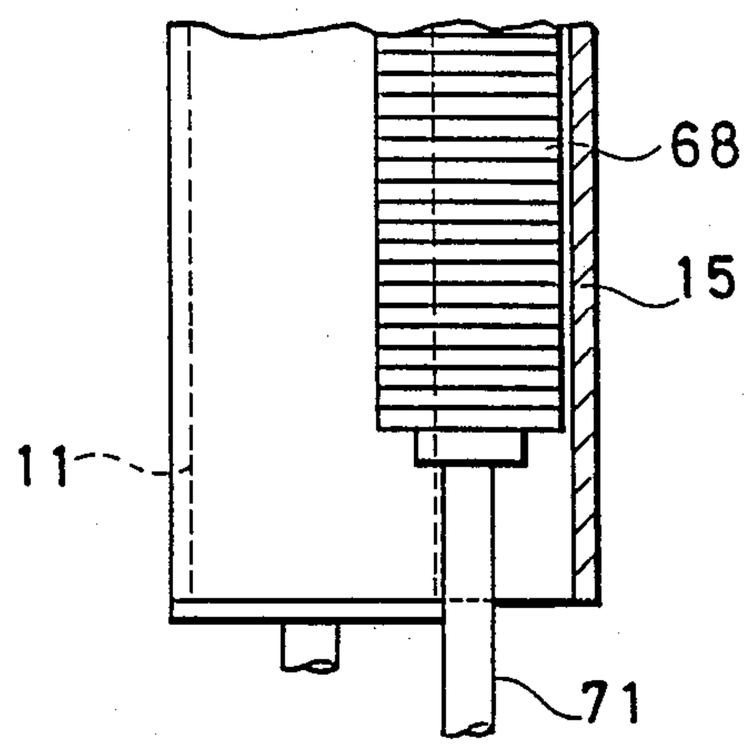

FIG. 22

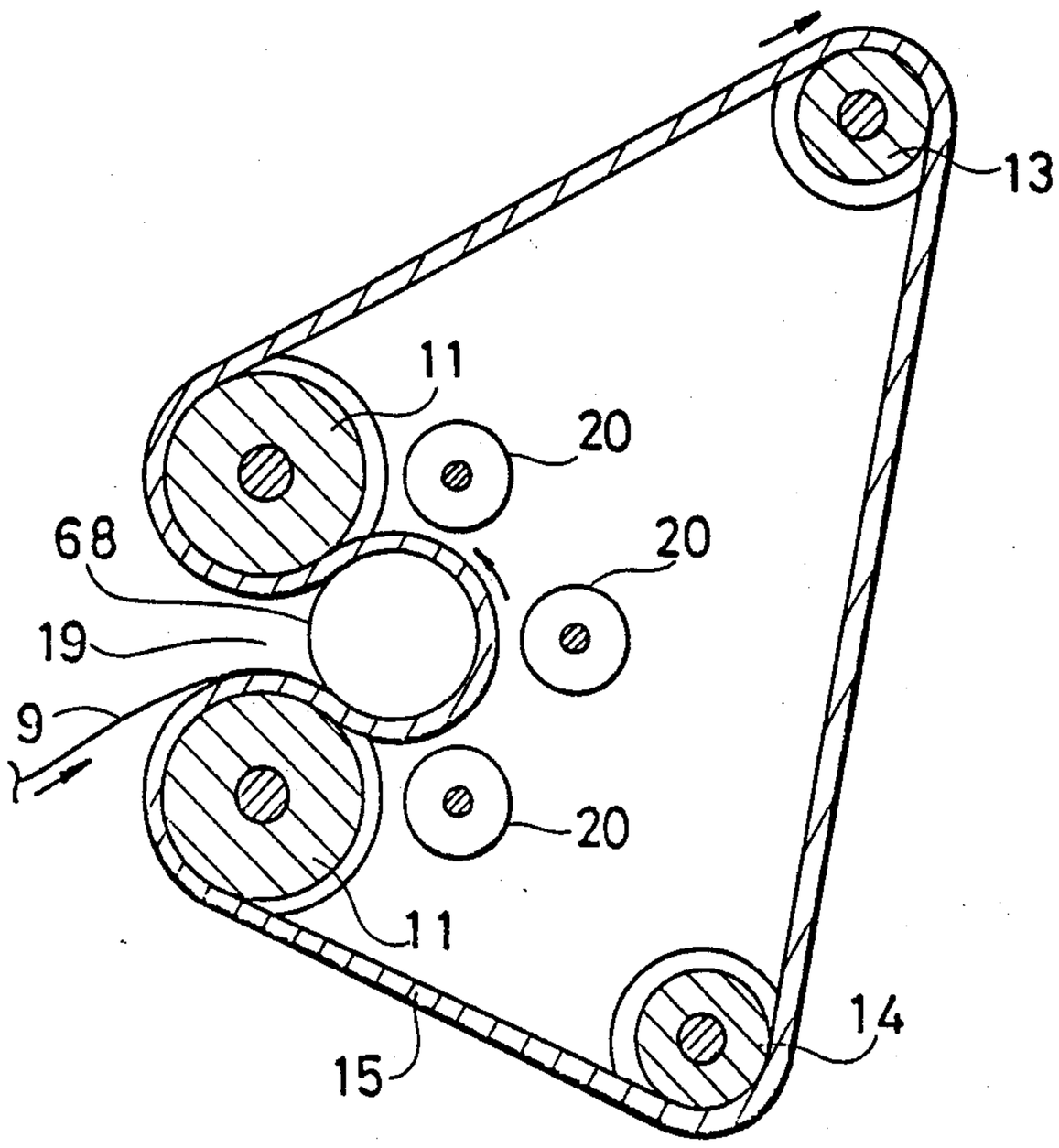

FIG. 23

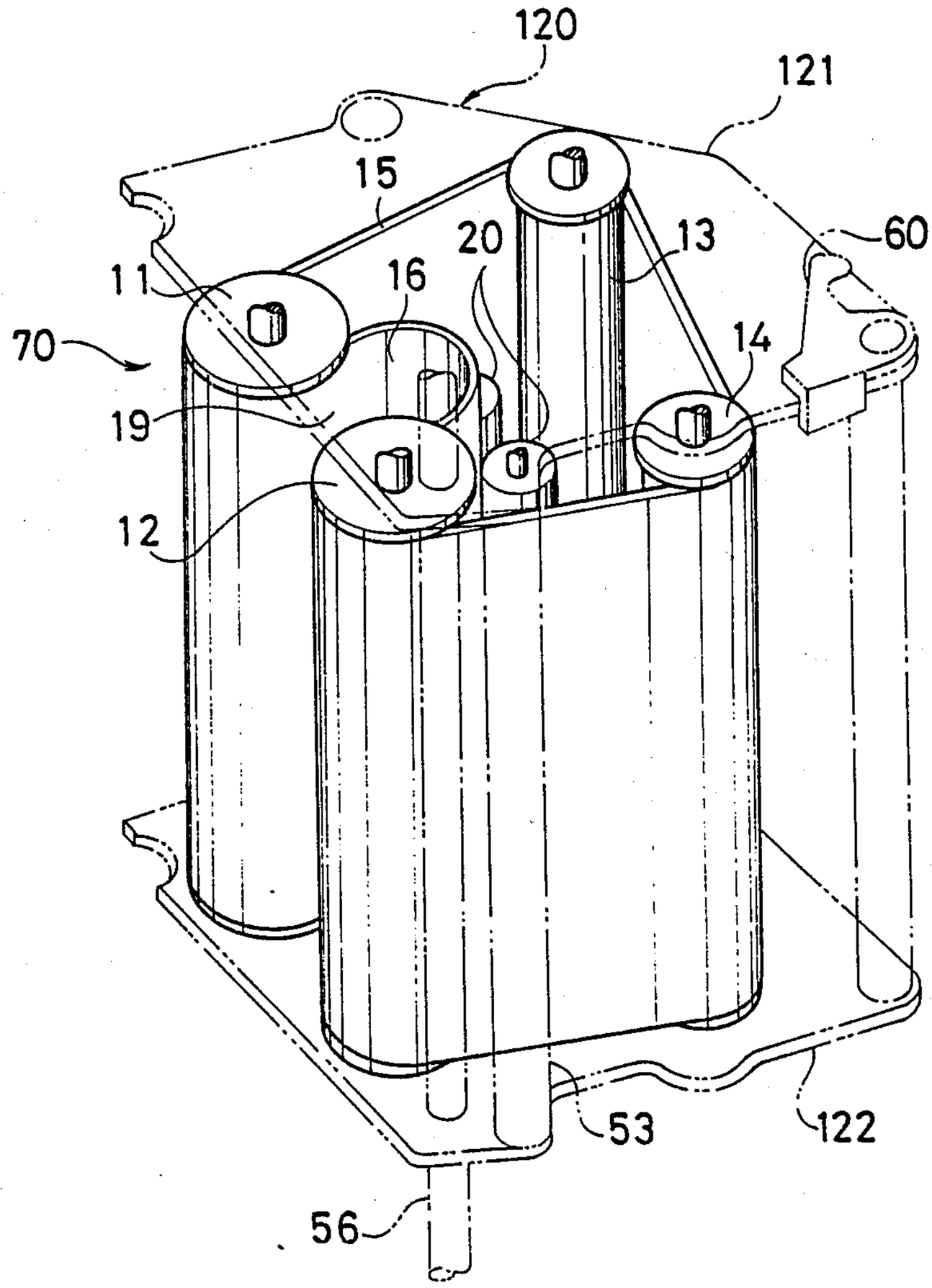

FIG. 24

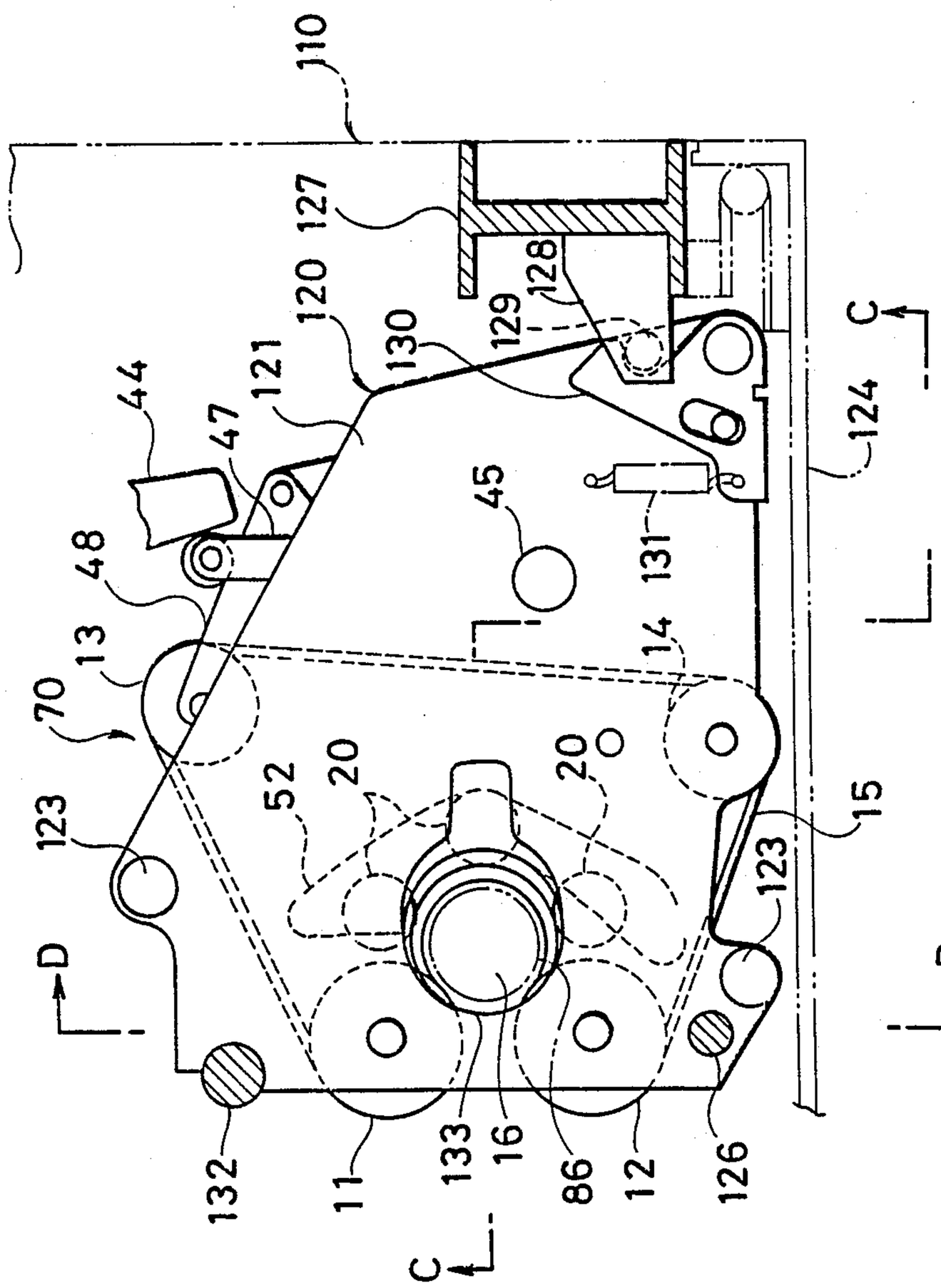
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FIG. 25

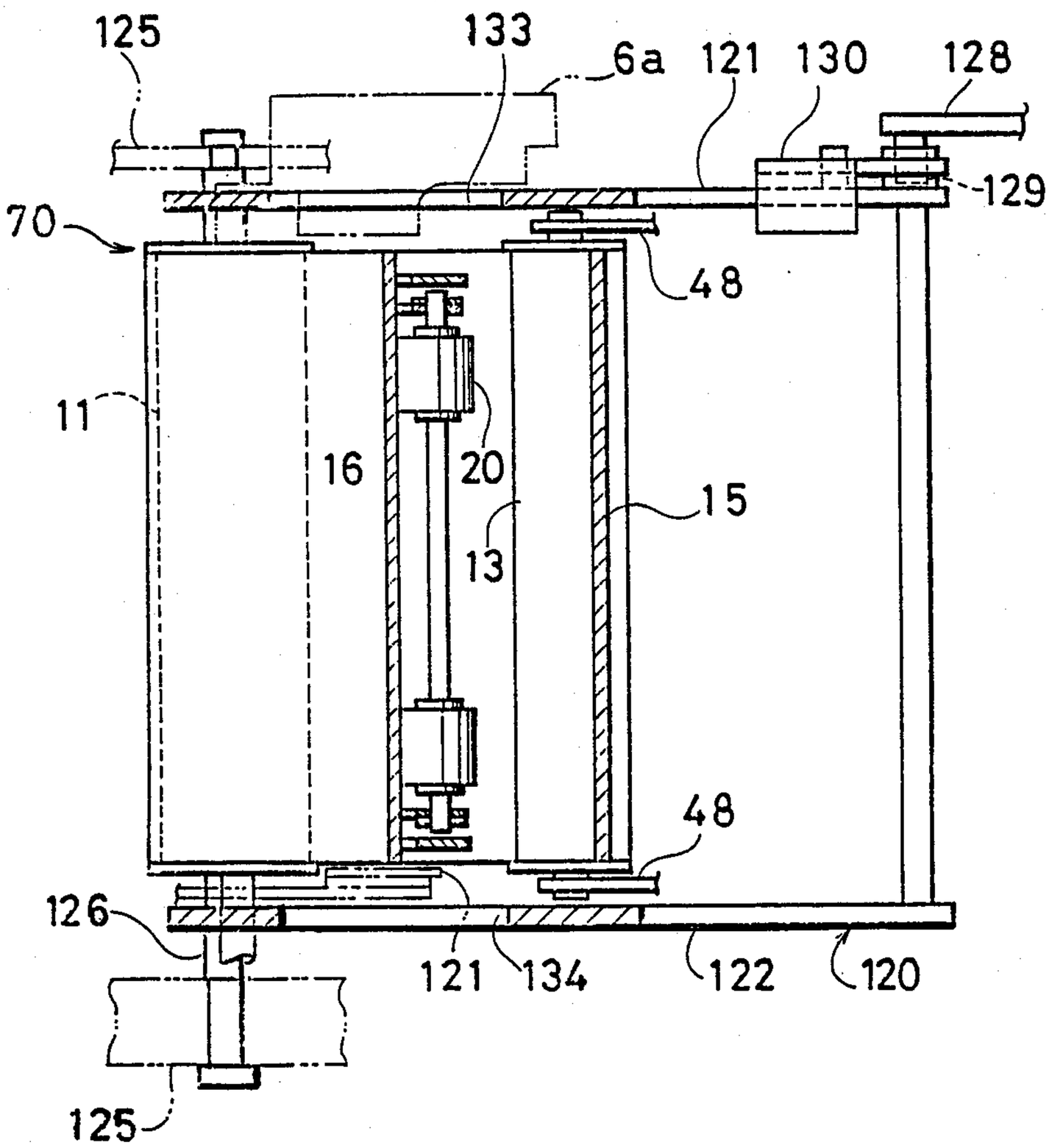
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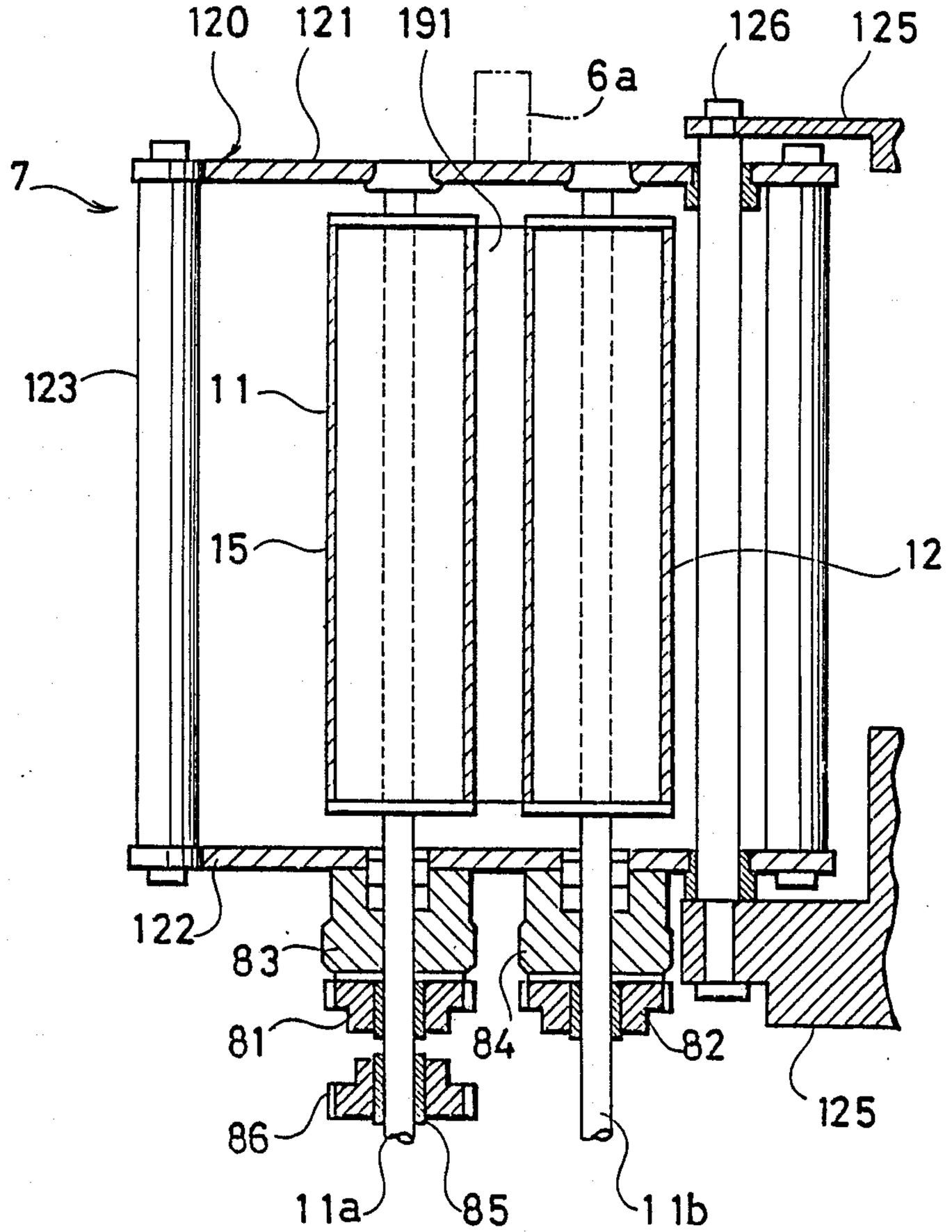
FIG. 26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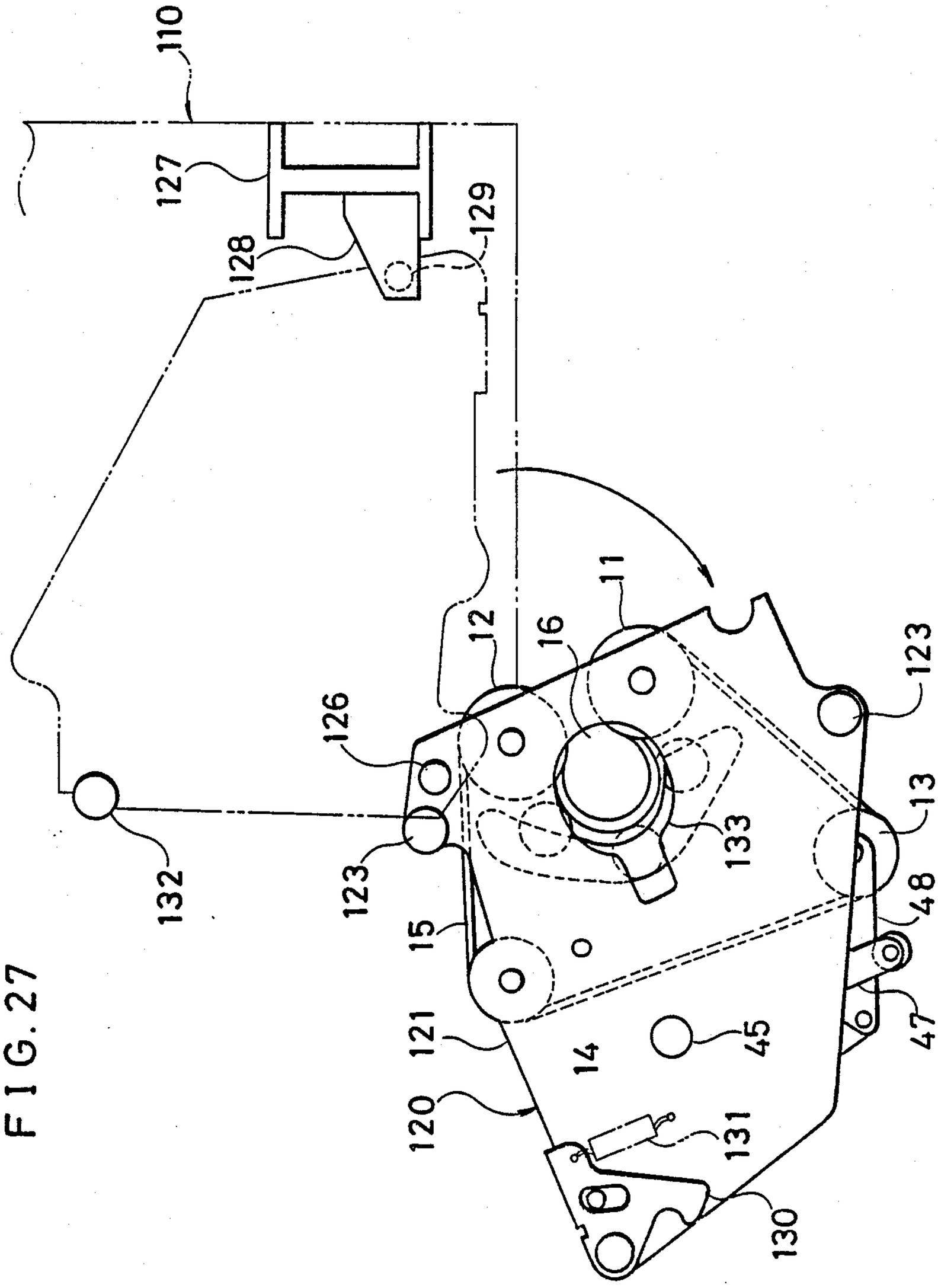
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FIG. 27

COIN WRAPPING APPARATUS

BACKGROUND OF THE INVENTION AND RELATED ART STATEMENT

This invention relates to a coin wrapping apparatus in which a specified number of coins are piled and the piled coins are wrapped in wrapping.

A conventional coin wrapping apparatus of this type, such as one disclosed in Japanese Examined Patent Publication No. 55-34048 or one in Japanese Examined Utility Model Publication No. 53-36284, includes a coin supply unit having a coin feeder, a coin counter and other devices necessary for coin supply, a coin piling unit for piling coins fed from the coin supply unit in a specified number, a coin wrapping unit for wrapping the piled coins in wrapping, and a unit for driving and controlling these units, whereby coins are automatically piled and wrapped.

The coin piling unit in the coin wrapping apparatus is so designed as to collect coins in a cylinder or coin arranging cylinder having a diameter corresponding to that of the coin. A coin wrapping appratus disclosed in the Japanese Examined Patent Publication No. 55-34048 which is applicable for a plurality types of coin having different sizes includes a coin arranging cylinder made up of many segments partially overlapping each other, a mechanism for cooperationally actuating the segments in radial directions and a mechanism for driving the actuating mechanism according to coin type setting operation, so that the coin arranging cylinder can be expanded and contracted.

In coin piling units, it is required to prevent coins from standing in a coin arranging cylinder so that they are properly piled in prostrated state in the cylinder. Japanese Examined Patent Publication No. 42-902 discloses a coin piling unit to achieve the above requirement which includes a coin arranging cylinder swingable in vertical and horizontal directions and an operating mechanism for swinging the cylinder according to rotation of a cam driven by a driver.

However, it will be apparent that this structure, in addition to members constituting the coin arranging cylinder, requires a mechanism for supporting the cylinder in such a way that it can be swung and the operating mechanism for swinging the cylinder, consequently making the construction complicated. In addition, if the above-mentioned expandable coin arranging cylinder, which is complicated in construction, is combined with the above-mentioned mechanism to give the cylinder a swing, the entire construction of coin piling unit greatly becomes complicated. Consequently, the problems are involved where constructability and reliability are reduced and construction cost is increased.

Furthermore, a conventional coin wrapping apparatus, separately from a coin piling unit, has a coin wrapping unit in order to fulfill the function of piling a specified number of coins in the proper way and the function of wrapping coins. The coin wrapping unit is provided under the coin piling unit and includes three rotatable rollers. In the coin wrapping unit, a pile of coins conveyed from the coin piling unit is positioned between the rollers. Wrapping is introduced from a wrapping supply unit to a clearance between the rollers and the pile. Simultaneously, the rollers are rotated to wrap the pile in wrapping. However, it will be seen that such separate provision of a coin piling unit and a coin wrapping unit inevitably requires to separately provide their

respective components such as a coin arranging cylinder and rollers, and mechanisms for driving and controlling the components, consequently requiring an increased number of components for the unit. Also, since the coin piling unit and the coin wrapping unit are positioned in the vertical direction, the overall height of the coin wrapping apparatus becomes greater. Therefore, such conventional coin wrapping apparatus has disadvantages of having larger size and greater weight.

Moreover, in conventional coin wrapping apparatus, components constituting the coin wrapping unit are provided at specified positions in a main body of a coin wrapping apparatus with being mounted on the fixed frame attached to a main body of the coin wrapping apparatus. Accordingly, when a jam occurs in the wrapping unit due to its improper wrapping process, it is inconvenient to remove jammed wrapping. Also, maintenance is very cumbersome. More specifically, when jam occurs in the wrapping unit, it is required that a door provided in a front panel or side panel of the main body is firstly opened and a hand, a pincette, or other similar tool is inserted through the door and the jammed wrapping is finally removed from a space between the wrapping rollers. Accordingly, smooth removal is difficult and the removing operation is troublesome.

It is therefore an object of the present invention to provide a coin wrapping apparatus which eliminates the abovementioned disadvantages.

Other objects and advantages of the present invention will become apparent from the following description.

SUMMARY OF THE INVENTION

According to the present invention, a coin wrapping apparatus for wrapping a pile of coins in wrapping comprises a coin piling unit for piling coins in a specified number, the coin piling unit comprising a belt having a specified width and passed over a pair of main rollers and a guide roller arranged in parallel at a given interval, coin holding means formed by bending a portion of the belt between the pair of main rollers into a curved shape for piling and holding a specified number of coins fed from a coin supply unit, back-up rollers provided on the back of the portion of the belt in which the coin holding means is formed, and driving means for rotating the pair of main rollers so as to drive the belt when coins are fed in the coin holding means.

With the above-mentioned coin wrapping apparatus, coins are piled in the coin holding means or the curved portion of the belt. When coins are piled, the belt is driven so as to give a torque to coins. Consequently, coins are prevented from standing. Since the belt serves both as coin holding means and as a part of a driving mechanism for rotating the belt so as to prevent coins from standing, coin piling function can be achieved in a relatively simple structure. Furthermore, by constructing one of the guide rollers and the backup rollers so as to adjust their respective positions, the coin holding means formed by the belt can be expanded and constracted by adjusting their positions. Accordingly, the diameter of the coin holding means can be easily adjusted according to the types of coin.

Furthermore, the present invention provides a coin wrapping apparatus comprising a coin piling and wrapping unit for piling and arranging coins fed from a coin supply unit in a specified number and wrapping a pile of coins in wrapping supplied from a wrapping supply

unit, the coin piling and wrapping unit comprising a belt having a specified width and passed over a pair of main rollers and a guide roller arranged in parallel at a specified interval, coin holding means formed by bending a portion of the belt between the pair of main rollers into a cylinder having a top opening, a bottom opening, and an side opening for introducing wrapping between the main rollers, backup roller provided on the back of the portion of the belt in which the coin holding means is formed, the side opening being at an ahead position in a moving direction of wrapping from a wrapping supply unit, a movable coin support device, a movable crimping hook, and a driving device for rotating the pair of main rollers so as to drive the belt.

Accordingly, coins are piled and wrapped in the coin holding means formed by the curved portion of the belt. In other words, functions of piling and wrapping are performed in a common unit and a driving means is used for piling and wrapping. This makes a coin piling and wrapping section compact, providing a smaller and lighter coin wrapping apparatus. Also, since piling and wrapping are performed in the same section, an improved wrapping efficiency is obtainable.

Furthermore, the present invention provides a coin wrapping apparatus in which main parts of the above-mentioned coin piling and wrapping unit including the pair of main rollers, guide roller, belt and backup rollers are supported by a support frame, one side of the support frame being axially supported on a main body of the coin wrapping apparatus by a longitudinal rod so that the support frame carrying the main parts of the coin piling and wrapping unit are moved about the longitudinal rod from an inserted state that the support frame is entirelY positioned in the main body of the coin wrapping apparatus to a withdrawn state that the support frame is mostly positioned outside the main body of the coin wrapping apparatus and vice versa, with a releasable stopper provided between the support frame and the main body of the coin wrapping apparatus for maintaining the inserted state.

Accordingly, when a jam occurs in the coin piling and wrapping unit, the piling and wrapping unit are mostly moved outside the main body of the coin wrapping apparatus to remove jammed wrapping. Accordingly, if jam or other troubles take place, necessary operations such as removal of jammed wrapping can be easily performed outside the main body of the coin wrapping apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic view showing an internal mechanism of a first coin wrapping apparatus of the present invention;

FIG. **2** is a perspective view showing a main construction of a coin piling unit of the coin wrapping apparatus;

FIG. **3** is a horizontal sectional view of the coin piling unit;

FIG. **4** is a sectional view taken along line A—A of FIG. **3**;

FIG. **5** is a vertical sectional view of the coin piling unit showing a means for driving a belt;

FIG. **6** is a horizontal sectional view of the coin piling unit showing a mechanism for adjusting the position of a guide roller;

FIG. **7** is a horizontal sectional view of the coin piling unit showing a mechanism for adjusting the position of backup rollers;

FIG. **8** is a side view of the mechanism for adjusting the position of backup rollers;

FIG. **9** is a plan view of a shutter provided in the coin piling unit showing its operation;

FIGS. **10** and **11** are views explaining operation of the coin piling unit;

FIG. **12** is a diagrammatic view showing an internal mechanism of a second coin wrapping apparatus of the present invention;

FIG. **13** is a horizontal sectional view of a coin wrapping device of the second coin wrapping apparatus;

FIG. **14** is a sectional view taken along line B—B of FIG. **13**;

FIG. **15** is a horizontal sectional view of the coin wrapping device showing a mechanism for adjusting the position of a guide roller;

FIG. **16** is a vertical view of the coin wrapping device showing a device for driving a belt;

FIG. **17** is a schematic plan view of the driving device;

FIG. **18** is a view showing operation of a support rod provided in the coin wrapping device;

FIG. **19** is a view showing operation of a center guide provided in the coin wrapping device;

FIG. **20** is a view showing operation of a crimping hook provided in the coin wrapping device;

FIGS. **21** and **22** are views explaining operation of the coin wrapping device;

FIG. **23** is a perspective view of a mounting portion of a coin wrapping device of a third coin wrapping apparatus of the present invention;

FIG. **24** is a plan view of the mounting portion;

FIG. **25** is a sectional view taken along line C—C of FIG. **24**;

FIG. **26** is a sectional view taken along line D—D of FIG. **24**;

FIG. **27** is a plan view of the mounting portion showing an opened state thereof.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

A first embodiment of the present invention will be described with reference to FIGS. **1** through **11**. Referring to FIG. **1**, a coin wrapping apparatus has a hopper **1** for depositing coins in its top portion. Coins are transferred from the hopper **1** to a rotarY disc **3** by a belt conveyor **2**. The rotary disc **3** causes coins to move through a predetermined portion of the periphery thereof to a coin passage **4** by virtue of centrifugal force. Coins are then delivered one by one through the coin passage **4** to a chute **6** by a belt **5** provided at a position opposite to the coin passage **4**. When a specified number of coins are counted by coin counting device (not illustrated) provided on the coin passage, the coin delivery is stopped. Coins delivered from the coin passage **4** is supplied through the chute **6** to a coin piling unit **7** which will be described in detail later. The above described construction constitutes a coin supply unit of the coin wrapping apparatus.

Below the coin piling unit **7** is provided a coin wrapping unit **8**. The coin wrapping unit **8** is constructed so as to wrap a pile of coins conveyed from the coin piling unit **7** by means of an elevatable coin support in wrapping **9** supplied from a wrapping supply unit. A specific construction is not illustrated. However, it is appropriate to use a conventional wrapping unit in which a pile of coins is wrapped by positioning the pile of coins between three rollers being synchronously rotated,

introducing wrapping **9** into a clearance between the rollers, wrapping the pile of coins in the wrapping **9** with the pile being rotated, and crimping top and bottom ends of the wrapping by a crimping hook. A wrapped pile of coins is transferred through a discharge passage not illustrated) to a discharge opening.

A main construction of the coin piling unit **7** will be described with reference to FIGS. **2** through **4**. Referring to these figures, the coin piling unit **7** includes a belt **15** having a specified width larger than the height of a pile of coins having a specified number of coins. The belt **15** is passed over a pair of main rollers **11** and **12** and a desirable number of guide rollers. In this embodiment, two guide rollers **13** and **14** are provided. A coin holding means **16** for piling coins is formed by the belt **15**.

The rollers **11, 12, 13, 14** are so arranged that their respective axes are vertical and in parallel with one another. The pair of main rollers **11** and **12** are arranged at a distance smaller than the diameter of coin and rotatably mounted on an upper support plate **17** and a lower support plate **18**. The rollers **11, 12** are rotated at a predetermined time by a driving means which will be described later. The guide rollers **13** and **14** are rotatably provided at a proper distance from the main rollers **11** and **12**. The guide roller **13** is horizontally moved by a position adjusting mechanism which will be also described later.

The belt **15** has such a length as to make it possible to bend inward at a position between the pair of main rollers **11** and **12** to form a curved shape. The belt **15**, which is passed over the main rollers **11** and **12** and the guide rollers **13** and **14**, provides the coin holding means **16** in the form of substantially cylinder at the curved portion. The belt **15** is continuously moved by the main rollers **11** and **12** while being tensioned at a portion extending from the main roller **11** through the guide rollers **13** and **14** to the main roller **12**, and loosened so as to keep the curve portion between the main rollers **11** and **12**. The belt **15** is a toothed belt. The circumferential surface of each of the main rollers **11** and **12** has teeth for engaging the teeth on the belt **15**.

On the back of the curved portion of the belt **15** where the coin holding means **16** is formed are provided backup rollers **20** in a desirable number, three in this embodiment. The backup rollers **20** are arranged along the curved portion of the belt **15** so that the curved portion is held in the form of a cylinder. The backup rollers are horizontally moved by a position adjusting mechanism which will be described later.

The top opening of the coin holding means **16** corresponds to a bottom opening of the chute **6** of the coin supply unit. In a portion corresponding to the bottom opening of the coin holding means **16** is provided an openable shutter **21** to form a bottom of the coin holding means **16**. The coin holding means **16** has a side opening **19** between the main rollers **11** and **12**. To prevent coins from escaping through the side opening **19**, a center guide **23** is provided in a position corresponding to the side opening **19**. FIG. **5** shows a driving device **30** for rotating the main rollers **11** and **12** to drive the belt **15** when coins are piled and wrapped. However, some minor parts are omitted. The driving device **30** comprises gears **31** and **32** mounted on rotating shafts **11***a* and **12***a* of the main rollers **11** and **12** for driving the main rollers **11** and **12**, clutches **33** and **34** for engaging the gears **31** and **32** with the rotating shafts **11***a* and **12***a*, a gear **35** meshed with the main roller driving gears **31** and **32**, and a transmission mechanism (not illustrated) including a belt, a pulley and an intermediate gear for transmitting rotation of a motor **36** to the gear **35**. The main roller driving gears **31** and **32** are synchronously rotated at a specified speed by driving force transmitted from the motor **36**. At this time, the clutches **33** and **34** are engaged, so that the rotation of said gears **31** and **32** is transmitted to the main rolers **11** and **12**. Consequently, the main rollers **11** and **12** are rotated. The clutches **33** and **34** are controlled by control means (not illustrated) so that the main rollers **11** and **12** are driven when coins are supplied from the coin supply unit to the coin holding means.

FIG. **6** shows a position adjusting mechanism for the guide roller **13**. FIGS. **7** and **8** show a position adjusting mechanism for the backup rollers **20**. As shown in these figures, the guide roller **13** and the backup rollers **20** are constructed so as to move respectively in accordance with rotation of an operating rod **40** which is connected to a coin type setting dial (not illustrated). The rod **40** is constructed so as to rotate following movement of the dial which is actuated pursuant to the types of coin to be wrapped. Rotation of the operating rod **40** is then transmitted to the guide roller **13** and the backup rollers **20**. Consequently, they are moved to expand and contract the coin holding means **16** at the curved portion of the belt. In other words, the diameter of the coin holding means **16** is controlled according to the diameter of coin, which is varied according to the types of coin.

More specifically describing these position adjusting mechanisms, the position adjusting mechanism for the guide roller **13** shown in FIG. **6** comprises a polygonal cam **41** provided on the operating rod **40**, lever **44** pivotable about a fulcrum shaft **42** and biased by a spring **43** so that a roll part **44***a* at one end of the lever comes into contact with the cam **41**, a movable block **47** pivotable about a fulcrum shaft **45** and biased by a spring **46** so that a roll part **47***a* at one end of the block comes into contact with the other end **44***b* of the lever **44**, and a guide roller supporting bracket **48** mounted on the movable block **47**. The guide roller **13** is rotatably mounted on the bracket **48**. Accordingly, when the cam **41** is rotated by the coin type setting operation, the lever **44** and the movable block **47** are pivoted to move the guide roller **13** along a circular arc whose center is at the fulcrum shaft **45**. Consequently, the coin holding means **16** is expanded or contracted to attain a diameter corresponding to the types of coin to be wrapped.

The position adjusting mechanism for the backup rollers **20** shown in FIGS. **7** and **8** comprises a movable frame **52** mounted on upper and lower supporting plates **17** and **18** by a shaft **51** and movable about one end thereof, an arm **53** for connecting the movable frame **52** to the other end **47***b* of the movable block **47**, and three sets of links **56, 57, 58** arranged between a shaft **54** mounted on the supporting plates **17** and **18** and a shaft **55** mounted on the movable plate **52**. The backup rollers **20** are carried by the links **56, 57, 58**. Accordingly, the movable block **47** is pivoted according to the coin type setting operation, so that the backup rollers **20** moves in cooperation with the movement of the guide roller **13**. In other words, the links **56, 57, 58** are displaced according to the rotation of the movable frame **52** cooperably connected with the movable block **47**. Consequently, the backup rollers **20** are moved in accordance with expansion and contraction of the coin holding means **16** when executing the coin type setting operation.

The shutter **21** forming the bottom of the coin holding means **16**, as shown in FIG. **9**, includes a pair of

shutter plates **21***a* and **21***b* mounted on shutter holding plates **61***a* and **61***b* which are cooperably connected with each other by a link **62**. The shutter **21** is biased by a spring **63** so as to close. When necessary, the shutter **21** is opened by a driving solenoid **64**, a link **65** and an arm **66**.

Operation of the above-described first embodiment of the present invention will then be described.

When a specified number of coins are supplied from the coin supply unit into the coin holding means **16** of the coin piling unit **7** and piled, the clutch **34** of the driving device **30** is firstly engaged to drive the main roller **12** positioned at the rear side in the moving direction of the belt relative to the coin holding means **16**. Consequently, the curved portion of the belt between the main rollers **11** and **12** is pressed against the backup rollers **20** to form the coin holding means **16** into the shape of a predetermined cylinder. Thereafter, the clutch **33** is engaged, so that the main rollers **11** and **12** are synchronously rotated at a constant speed. In this case, since the positions of the guide roller **13** and the backup rollers **20** are adjusted in advance by the coin type setting operation, the diameter of the coin holding means **16** is adjusted to such a diameter as to leave a very small space between the inner surface of the coin holding means and coins to be piled.

As shown in FIGS. **10** and **11**, the belt **15** forming the side wall of the coin holding means **16** is driven to move circumferentially as indicated by an arrow b due to the rotation of the main rollers **11** and **12** as indicated by arrows b. Simultaneously, a specified number of coins **68** are supplied one by one into the coin holding means **16** through the top opening. If a supplied coin **68** stands with leaning against the side wall of the coin holding means **16**, the belt **15** gives a torque to the standing coin **68**. Consequently, the coin is prostrated. This securely prevents coins from standing. Accordingly, coins **68** are piled in properly prostrated state.

When this coin piling operation is completed, the driving of the main rollers **11** and **12** is stopped and then the shutter **21** is opened. Simultaneously, a pile of coins is transferred by the elevatable support (not illustrated) to the coin wrapping unit **8**, where the coin wrapping operation is then performed.

Next, a second embodiment of the present invention will be described with reference to FIGS. **12** through **22**. In these figures, the parts identical with those of the first embodiment are indicated at the same reference numerals. A coin wrapping apparatus of the second embodiment has a coin piling and wrapping unit **70** which serves both as a coin piling unit and as a coin wrapping unit. Referring to FIG. **12** showing an entire internal mechanism of the coin wrapping apparatus, a coin supply unit including a hopper **1**, a belt conveyor **2**, a rotary disc **3**, a coin passage **4**, and a delivery belt **5** is the same as the first embodiment. A specified number of coins are supplied from the coin supply unit through a chute **6** to the coin piling and wrapping unit **70**. Wrapping **9** is supplied from a wrapping roller **10** of a wrapping supply unit located on a side of the coin piling and wrapping unit **70** to the coin piling and wrapping unit **70** through a wrapping feed mechanism and a cutter.

The coin piling and wrapping unit **70**, as shown in FIGS. **13** and **14**, has the same principal structure as the coin piling unit **7** of the first embodiment. Specifically, the coin piling and wrapping unit **70** comprises a pair of main rollers **11** and **12**, two guide rollers **13** and **14**, a belt **15** passed over these rollers and being bent inward at a portion between the main rollers **11** and **12** to form a curved shape, and three backup rollers **20** provided on the back of a coin holding means **16** formed by the curved portion of the belt **15**. These parts are the same in arrangement and form as the first embodiment.

The coin holding means **16** has a top opening, a bottom opening, and a side opening **19** between the main rollers **11** and **12**. In this embodiment, the side opening **19** serves as an opening for introducing wrapping. The top opening and the side opening **19** are so arranged that the former corresponds to the bottom opening of the chute **6** and the latter is ahead of a moving direction of wrapping **8** fed from a wrapping supply unit. In a portion corresponding to the bottom opening of the coin holding means **16** is provided a openable shutter **21**, as the first embodiment.

Furthermore, near the coin holding means **16** is provided a coin supporting device including a support rod **71** and a mechanism for operating the rod **71**, a center guide **72** for preventing coins from escaping from the side opening and guiding wrapping into the coin holding means **16**, and upper and lower crimping hooks **73** for crimping top and bottom ends of wrapping **8** when wrapping a pile of coins.

Respective positions of the guide roller **13** and the backup rollers **20** can be adjusted by position adjusting mechanisms by coin type setting operation. A position adjusting mechanism for the backup rollers **20** (not illustrated) has the same construction as the first embodiment (see FIGS. **7** and **8**). A position adjusting mechanism for the guide rollers **20**, as illustrated in FIG. **15**, has a solenoid **75** in addition to the construction of the position adjusting mechanism of the first embodiment. The solenoid **75** is mounted on a movable block **47** to contract the coin holding means **16** so as to bring the belt **15** into contact with the coins when wrapping. A guide roller supporting bracket **48** is rotatably mounted on the movable block **47** by a shaft **76** and also connected to the solenoid **75**. Accordingly, the guide roller **13** is allowed to move as the movable block **47** pivots according to the coin type setting operation. Also, the guide roller **13** is allowed to move in such a direction as to contract the coin holding means **16** when the solenoid **75** is operated. Indicated at **77** is a solenoid connected to a lever **44** for removing coins improperly piled in the coin holding means **16**. The solenoid **77** is operated when turning on a reject switch, so that the guide roller **13** is moved in such a direction as to expand the coin holding means **16**.

A driving device **80** for rotating the main rollers **11** and **12** so as to drive the belt **15** when piling and wrapping is shown in FIGS. **16** and **17**. Rotating shafts **11***a* and **12***a* of the first main roller **11** which is a main roller positioned ahead in the moving direction of the belt relative to the coin holding means **16** and the second main roller **12** which is a main roller positioned behind in the moving direction of the belt relative to the coin holding means **16** are respectively attached with high speed gears **81** and **82**. Also, the rotating shafts **11***a* and **12***a* are attached with first and second clutches **83** and **84** for engaging the gears **81** and **82** with the rotating shafts **11***a* and **12***a* respectively. Furthermore, the rotating shaft **11***a* of the first main roller **11** is attached with a low speed gear **86** and an one way clutch **85**. Between a main motor **87** serving as a driving source and the gears **81**, **82** and **86** is provided transmission device including a pulley **88**, a belt **89**, a pulley **90** and other transmission gears.

The transmission device includes a mechanism for transmitting rotation of the motor **87** to the high speed gears **81** and **82** in such a gear ratio through transmission gears **91, 92, 94** as to rotate the high speed gears at a high speed, for example, at 1200 r.p.m and a mechanism for transmitting rotation of the motor **87** to the low speed gear **86** in such a gear ratio through transmission gears **93, 95** and **96** as to rotate the low speed gear **86** at a low speed, for example, at 300 r.p.m. Also, the transmission device is provided with a third clutch **97** for turning on and off transmission of driving force. When the third clutch **97** is disengaged, the driving of the gears **81, 82** and **86** of the main rollers **11** and **12** is suspended. When the the third clutch **97** is engaged, the gears **81, 82** and **86** are driven. In this state, when the first and second clutches **83** and **84** are engaged, rotation of the high speed gears **81** and **82** is transmitted to the main rollers **11** and **12**. When the clutches **83** and **84** are disengaged, rotation of the low speed gear **86** is transmitted to the first main roller **11** through the one way clutch **85**. Furthermore, the transmission device of FIG. **17** is provided with a gear **98** for transmitting rotation of the main motor **87** through the transmission gear **93** to the wrapping roller **10** at a gear ratio to drive the wrapping roller **10** at a predetermined time, and a fourth clutch **99** for turning on and off transmission of driving force.

The supporting rod **71**, center guide **72** and crimping hooks **73** are operated by a main shaft **100** and their respective actuating devices. The main shaft is driven by a motor and reduction device. The actuating devices are shown in FIGS. **18, 19** and **20** respectively.

More specifically, the supporting rod **71** is mounted on a forward end of a movable arm **102** which is rotatable about a shaft **101** and elevatable along the shaft **101**. The supporting rod **71** is usually held at a position apart from the bottom opening of the coin holding means **16** as indicated by the two-dot chain lines. When coin piling operation moves to coin wrapping operation, the supporting rod **71** is moved to a position near to the bottom opening of the coin holding means **16** and then inserted in the coin holding means **16** after the shutter **21** is opened by cams for moving the supporting rod in a horizontal direction and cams for moving the supporting rod in a vertical direction, the cams being not shown in the drawing, and the arms **103** and **104**. The horizontal position at which the supporting rod **71** is stayed when moving to the near position to the coin holding means **16** and the position at which it is stayed when inserted in the coin holding means **16** are adjusted by a cam provided on an actuating rod **40** according to rotation of the actuating rod **40** by the coin type setting operation. Accordingly, the horizontal and vertical positions at which a pile of coins is supported when wrapping are adjusted according to the types of coin which have different diameters and thicknesses.

The center guide **72** is stayed at the position near to side opening for introducing wrapping **19** into the coin holding means **16** when piling. When crimping, the center guide **72** is moved to a position for allowing a crimping hook lever **107** to freely move by a center guide cam (not illustrated) provided on the main shaft **100** and arms **105** and **106**. The crimping hooks **73** mounted on the crimping hook lever **107** are stayed at a retracted position at a usual time. When crimping, the crimping hooks **73** are horizontally moved to positions near to the top and bottom openings of the coin holding means and then to crimping positions by cams for moving the crimping hooks horizontally and vertically (not illustrated) provided on the main shaft **100** and arms **108** and **109**.

The operation of the above-described second embodiment of the present invention will be described. When a specified number of coins are fed from the coin supply unit to the coin holding means **16**, coins are piled in properly prostrated state by virtue of the fact that the main rollers **11** and **12** are driven with the guide roller **13** and the backup rollers **20** being adjusted to appropriate positions by the coin type setting operation as the first embodiment.

When this coin piling operation is completed, the driving of the main rollers **11** and **12** is temporarily stopped. Thereafter, for the wrapping operation, the supporting rod **71** is moved to the near position to the bottom opening of the coin holding means **16**. After the shutter **21** is opened, the supporting rod **71** is raised to support a pile **68** of coins and more raised to move the pile **68** to a predetermined position (see FIG. **21**).

With wrapping operation, as shown in FIG. **22**, wrapping **9** supplied from the wrapping supply unit is introduced into the coin holding means **16** through the side opening **19**. Simultaneously, the solenoid **75** for driving the guide roller **13** is operated to contract the coin holding means **16**. Consequently, the portion of the belt **15** where the coin holding means **16** is formed comes into contact with the pile **68** of coins with the wrapping **9** being placed between them. The wrapping **9** is fed with being placed between them. The first main roller **11** is rotated at a relatively low speed. The rotation of the main roller **11** moves the belt **15** circumferentially and simultaneously rotates the pile **68** of coins. Also, the second main roller **12** is rotated following the rotation of the main roller **11**. Consequently, the wrapping **9** is wrapped around the pile **68** of coins. After a wrapping a specified length is wrapped around the pile **68** of coins, the upper and lower crimping hooks **73** are moved to the predetermined determined position and the main rollers **11** and **12** are then driven at a high speed so that the upper and lower ends of the wrapping protruding from the top and bottom of the pile **68** of coins are crimped. When the wrapping operation is completed, the supporting rod **71** is retracted and the wrapped pile of coins are discharged.

As this way, coin piling and coin wrapping are performed in a single coin holding means **16** formed by the belt **15**.

It should be noted that in the coin piling unit **7** of the first embodiment and the coin piling and wrapping unit of the second embodiment, guide rollers and backup rollers may be desirably increased or decreased. Also, it should be noted that mechanisms for adjusting the positions of these rollers, a driving device for rotating main rollers so as to drive a belt, a mechanism for actuating supporting rod, and a mechanism for actuating crimping hooks are not limited to the above-mentioned embodiments and may be desirably changed unless such changes depart from the scope of the present invention.

A third embodiment of the present invention will be described with reference to FIGS. **23** through **27**. In the third embodiment, the main parts of a coin piling and wrapping unit is supported on a supporting frame **120** which can be placed in and out of a main body of a coin wrapping apparatus **110**.

In the third embodiment, a coin piling and wrapping unit **70**, as the second embodiment, comprises a pair of main rollers **11** and **12**, two guide rollers **13** and **14**, a

belt **15** passed over these rollers, three backup rollers **20** provided on the back of a coin holding means **16** formed by a curved portion of the belt **15**, a shutter **21**, a supporting rod, a center guide and crimping hooks. However, the supporting rod, center guide and crimping hooks are not illustrated. Rotating shafts **11***a*, **12***a* of the main rollers **11** and **12** are rotatably mounted on upper and lower supporting plates **121** and **122** of a supporting frame **120**. The portions of the rotating shafts **11***a* and **12***a* which protrude below the lower supporting plate **122** are attached with high speed gears **81** and **82**, clutches **83** and **84**, a one way clutch **85** and a low speed gear **86**. These gears constitute a device for driving the belt **15**. As described in the second embodiment, rotation of a motor is transmitted to the high speed gears **81** and **82**, and the low speed gear **86** at a proper gear ratio through a transmission device (see FIG. **26**). The guide roller **13** is movably mounted on the supporting plates **121** and **122** by a movable block **47** and a bracket **48**. The guide roller **14** is fixedly mounted on the supporting plates **121** and **122**.

Mechanisms for adjusting the positions of the guide roller **13** and the backup rollers **20** are also constructed in the same manner as the second embodiment. A fulcrum shaft **45** of a movable block **47** is mounted on the support plates **121** and **122**. The backup rollers are movably mounted on the support plates **121** and **122** by the position adjusting mechanism.

The support frame **120** is constructed by connecting the upper and lower support plates **121** and **122** by a plurality of rods **123**. The support frame **120** is pivotably mounted to the main body of the coin wrapping apparatus **110**. Specifically, the forward side end of the support frame **120** which is near a door **124** of the main body of the coin wrapping apparatus **120** is axially supported on a fixed frame **125** of the main body of the coin wrapping apparatus **110** by a longitudinal rod **126**. Consequently, the support frame **120** can be moved in such a manner as to bring the frame **120** into an inserted state that the coin piling and wrapping unit is entirely positioned in the main body of the coin wrapping apparatus **110** as illustrated in FIG. **24**, or into a withdrawn state that the support frame **120** is mostly positioned outside the main body of the coin wrapping apparatus **110** as illustrated in FIG. **27**.

Between the other forward side end of the support frame **120** and the main body of the wrapping apparatus **110** is provided a releasable stopper for maintaining the inserted state. The stopper includes an engaging projection **129** provided on a member **128** laterally protruded from a fixed frame **127** of the main body of the wrapping apparatus **110** and a hook-shaped engaging piece **130** rotatably mounted on the support frame **120**. When the coin piling and wrapping unit is in the inserted state, the engaging piece **130** is biased by a spring **131** so as to engage the engaging projection **129**. Indicated at **132** is a rod-shaped stopper provided in the main body of the coin wrapping apparatus **110**. When the coin piling and wrapping unit is in the inserted state, a rear side end of the support frame **120** is made in contact with the stopper **132**.

In portions of the upper and lower support plates **121** and **122** which correspond to the coin holding means **16** are provided holes **133** and **134** for allowing coins to pass. In addition, to the upper support plate **121** is attached a lower half portion **6***a* of a coin guide chute **6**. A shutter **21** is mounted on the lower support plate **122**. The supporting rod, center guide and crimping hooks, not being illustrated, are movably provided at specified positions in the main body of the wrapping apparatus **110** through their respective actuating mechanisms.

The operation of the above-described third embodiment will be described. The coin piling and wrapping unit **70**, as illustrated in FIG. **24**, is kept in the inserted state that it is entirely positioned inside the main body of the coin wrapping apparatus **110** at a usual time. In this state, coin wrapping operation is carried out as described in the second embodiment.

During the coin wrapping operation, if jam occurs in the coin piling and wrapping unit, the support frame **120** and the main parts of the coin wrapping unit mounted on the support frame **120** are brought into the withdrawn state as illustrated in FIG. **27**. Consequently, jammed wrapping is removed with ease. More specifically, when jam occurs, the door **124** of the main body of the coin wrapping apparatus is opened and then the engaging piece **130** is disengaged from the engaging projection **129**. Thereafter, the support frame **120** is rotated forward about the longitudinal rod **126**, so that the support frame **120**, the main rollers **11** and **12**, the guide rollers **13** and **14**, the backup rollers **20**, a part of the driving device, and a part of the position adjusting mechanisms are moved forwardly. Accordingly, jammed wrapping is easily removed from the top or bottom portion of the coin holding means **16**, or the side opening **19**. After jammed wrapping is removed, the support frame **120** is easily returned to the inserted state by pushing it to the inside of the main body of the coin wrapping apparatus. Also, the supporting frame **120** is assuredly set at the proper position by the stopper **132**.

What we claim is:

1. A coin stacking apparatus for stacking coins in a vertical stack, comprising a support means, a pair of main rollers mounted on said support means for rotation about vertical axes, said main rollers being spaced from one another, guide roller means mounted on said support means spaced from said main rollers, said guide roller means comprising a guide roller having an axis which is vertically disposed, an endless belt disposed about said main rollers and said guide roller means, said endless belt passing over said main rollers and extending past said main rollers to form a substantially cylindrical loop section which opens up into the space between said pair of main rollers, said loop section having an inner side and an outer side, said inner side receiving said coins to be stacked, backup roller means disposed on said support means about the outside of said loop section for supporting the outside of said loop section while said coins are being stacked in said loop section, and a drive means for driving said endless belt about said main rollers and said guide roller means as said coins are fed downwardly into said loop section to be stacked in the inner side of said loop section as said backup roller means support the outside of said loop section.

2. A coin stacking apparatus according to claim **1**, wherein said loop section has an inner diameter corresponding substantially to the diameter of the coins to be stacked, and further comprising adjusting means for adjusting said diameter to thereby provide for stacking coins of different diameters.

3. A coin stacking apparatus according to claim **2**, wherein said adjusting means comprises linkage means for varying the spacing between said guide roller and said main rollers to thereby adjust the diameter of said

loop section so that said loop section can stack different diameter coins.

4. A coin stacking apparatus according to claim 1, further comprising adjusting means for adjusting the position of said backup roller means relative to said main rollers to thereby support loop sections of different diameters.

5. A coin stacking apparatus according to claim 1, further comprising adjusting means for adjusting the position of said guide roller relative to said main rollers and for adjusting the position of said backup roller means relative to said main rollers to thereby adjust the diameter of said loop section to stack different diameter coins.

6. A coin stacking apparatus according to claim 5, wherein said adjusting means comprises a control element which is movably adjustable to simultaneously adjust the position of said guide roller and said backup roller means.

7. A coin stacking apparatus according to claim 1, wherein said backup roller means comprises a plurality of backup rollers disposed in a partial circular array corresponding to the circular configuration of said loop section such that said backup rollers support said loop section substantially in the form of a cylinder.

8. A coin stacking apparatus according to claim 7, wherein said backup roller means comprises block support means for supporting said backup rollers, and pivotal support means for pivoting said block support means to different positions depending on the diameter of the coins to be stacked.

9. A coin stacking apparatus according to claim 1, wherein said loop section has an upper end and a lower end, further comprising shutter means at said lower end movable between an underlying position underlying said loop section and a position spaced from said underlying position.

10. A coin stacking apparatus according to claim 1, further comprising a guide means juxtaposed to said space between said main rollers for preventing coins from escaping through said space between said main rollers.

11. A coin stacking apparatus according to claim 1, wherein said drive means comprises drive elements for driving said main rollers and clutch means between said drive elements and each of said main rollers such that said main rollers can be separately driven and synchronously driven.

12. A coin stacking apparatus according to claim 1, wherein the space between said main rollers is less than the diameter of the coins being stacked.

13. A coin stacking apparatus according to claim 1, wherein said guide roller is designated a first guide roller, said guide roller means further comprising a second guide roller spaced from said first guide roller and having an axis which is vertically disposed, said second guide roller and said main rollers being mounted in fixed positions on said support means, said guide roller means comprising adjusting means for adjusting the position of said first guide roller relative to said main rollers and relative to said second guide roller to thereby adjust the diameter of said loop section to stack different diameter coins.

14. A coin stacking and wrapping apparatus for stacking coins in a vertical stack and for wrapping said vertical stack with a wrapping material comprising a support means, a pair of main rollers mounted on said support means for rotation about vertical axes, said main rollers being spaced from one another, guide roller means mounted on said support means spaced from said main rollers, said guide roller means comprising a guide roller having an axis which is vertically disposed, an endless belt disposed about said main rollers and said guide roller means, said endless belt passing over said main rollers and extending past said main rollers to form a substantially cylindrical loop section which opens up into the space between said pair of main rollers, said loop section having an inner side and an outer side, said inner side receiving said coins to be stacked, wrapping means operable to feed wrapping material into said space between said two mains rollers, and drive means for driving said endless belt about said main rollers and said guide roller means as said coins are fed downwardly into said loop section to thereby stack said coins in said loop section and subsequently wrap said stacked coins in said loop section with said wrapping material.

15. A coin stacking and wrapping apparatus according to claim 14, wherein said wrapping means comprises positioning means for positioning said stack in said loop section after the stacking has been completed, such positioning being effected prior to wrapping of said coins with said wrapping material.

16. A coin stacking and wrapping apparatus according to claim 15, wherein said positioning means is operable to raise said stacked coins to a predetermined position in said loop position.

17. A coin stacking and wrapping apparatus according to claim 16, wherein said positioning means comprises a support rod having an operating position underlying said stack in said loop section and vertically movable to raise said stack to said predetermined position.

18. A coin stacking and wrapping apparatus according to claim 17, wherein said positioning means comprises operable means operable to move said support rod between said operable position underlying said stack and another position horizontally spaced from said operable position.

19. A coin stacking and wrapping apparatus according to claim 14, wherein said loop section has a top end and a bottom end and said stack has a top and a bottom, said wrapping means further comprising crimping means juxtaposed to said top and bottom ends of said loop section for crimping said wrapping material at the top and bottom of said stack after said wrapping material has been wrapped around said stack.

20. A coin stacking and wrapping apparatus according to claim 19, wherein said crimping means comprises operable means for moving said crimping means to an operable position underlying and overlying said stack and to another position spaced from said operable position.

21. A coin stacking and wrapping apparatus according to claim 14, further comprising a guide means having an operable position juxtaposed to said space between said main rollers for preventing coins from escaping through said space while said coins are being stacked, and operable means operable to move said guide means between said operable position and another position spaced from said operable position.

22. A coin stacking and wrapping apparatus according to claim 14, further comprising backup roller means disposed on said support means about the outside of said loop section for supporting the outside of said loop section.

23. A coin stacking and wrapping apparatus according to claim 22, wherein said loop section has an inner

diameter corresponding substantially to the diameter of the coins to be stacked, and further comprising adjusting means for adjusting said diameter to thereby provide for stacking coins of different diameters.

24. A coin stacking and wrapping apparatus according to claim **23**, wherein said adjusting means comprises actuating means operable to move said guide roller relative to said main rollers after stacking has been completed to cause wrapping material which has been fed between said stack and said loop section to be engaged between said stack and said loop section and wrapped around said stack as said belt moves over said main rollers and said guide roller means.

25. A coin stacking and wrapping apparatus according to claim **23**, wherein said wrapping means is operable to feed wrapping material to said space between said main rollers, said adjusting means comprising actuating means which is operable to move said guide roller relative to said main rollers after said stacking has been completed such that said wrapping material which has been bed to said space between said main rollers is engaged between said loop section and said stack and wrapped around said stack as said belt moves over said main rollers and said guide roller means.

26. A coin stacking and wrapping apparatus according to claim **25**, wherein said adjusting means comprises a mechanical linkage means mechanically connected to said guide roller and said backup roller means and a movable control element which is movable to different positions for controlling said mechanical linkage means such that said mechanical linkage means simultaneously adjusts the position of said guide roller and said backup roller means, said adjusting means comprising a solenoid means operably connected to said mechanical linkage means and operable to actuate said mechanical linkage means to move said guide roller relative to said main rollers without movement of said control element.

27. A coin stacking and wrapping apparatus according to claim **14**, wherein said drive means comprises a gearing means, and clutch means operable to connect and disconnect said gearing means to thereby provide for driving one or both of said main rollers and to provide for driving said main rollers at different speeds.

28. A coin stacking and wrapping apparatus according to claim **14**, wherein said support means comprises a main frame and a support structure; pivotable means pivotably mounting said support structure on said main frame; said main rollers, said guide roller means, and said backup roller means being mounted on said support structure; said support structure being pivotably between an operable position wherein said support structure is disposed substantially within said main frame and another position in which said support structure is disposed substantially outside of said main frame to facilitate servicing; and latch means for latching said support structure in said operating position.

29. A coin stacking and wrapping apparatus according to claim **28**, wherein said support structure comprises spaced upper and lower support plates, and support rods connecting said support plates.

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